# PROCEEDINGS

*of*

# THE FLORIDA STATE HORTICULTURAL SOCIETY *for*

# 1935

**PUBLISHED BY THE SOCIETY**

THE E. O. PAINTER PRINTING COMPANY, DELAND, FLORIDA

# PROCEEDINGS

OF THE

## FORTY-EIGHTH ANNUAL MEETING

OF THE

## *Florida State Horticultural Society*

HELD AT

VERO BEACH, FLORIDA
APRIL 9, 10 AND 11

1935

PUBLISHED BY THE SOCIETY
OFFICE OF PUBLICATION, DELAND, FLORIDA

# Florida State Horticultural Society
# Officers Elect for 1936

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PRESIDENT

JOHN S. TAYLOR, Largo

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VICE-PRESIDENTS

S. F. POOLE
Lake Alfred

C. W. LYONS
Tampa

C. I. BROOKS
Miami

DR. DAVID FAIRCHILD
Honorary
Krome Memorial Institute
Coconut Grove

PAUL M. HOENSHEL
Krome Memorial Institute
Port Mayaca

---

SECRETARY

BAYARD F. FLOYD, Davenport

---

ASSISTANT SECRETARIES

W. W. YOTHERS, Orlando
J. LEE SMITH, Gainesville

---

TREASURER

N. A. REASONER, Oneco

---

EXECUTIVE COMMITTEE

F. M. O'BYRNE, Lake Wales

H. HAROLD HUME, Gainesville

T. RALPH ROBINSON, Orlando

# Constitution

Article 1. This organization shall be known as the Florida State Horticultural Society, and its object shall be the advancement of Horticulture.

Article 2. Any person or firm may become an annual member of the Society by subscribing to the Constitution and paying two dollars. Any person or firm may become a perennial member of the Society by subscribing to the Constitution and paying the annual dues for five or more years in advance. Any person or firm may become an annual sustaining member of the Society by subscribing to the Constitution and paying ten dollars. Any person may become a life member of the Society by subscribing to the Constitution and paying twenty-five dollars. Any person or firm may become a patron of the Society by subscribing to the Constitution and paying one hundred dollars.

Article 3. Its officers shall consist of a President, three Vice-Presidents, Secretary, Treasurer and Executive Committee of three, who shall be elected by ballot at each annual meeting. These officers shall take their positions immediately following their election.

Article 4. The regular annual meeting of this Society shall be held on the second Tuesday in April, except when ordered by the Executive Committee.

Article 5. The duties of the President, Vice-Presidents, Secretary and Treasurer shall be such as usually devolve on these officers. The President, Secretary and Treasurer shall be ex-officio members of the Executive Committee.

Article 6. The Executive Committee shall have authority to act for the Society between annual meetings.

Article 7. The Constitution may be amended by vote of two-thirds of the members present.

Article 8. A section of the annual program of the Society shall be devoted to the discussion of sub-tropical fruits, exclusive of the commonly grown varieties of citrus fruits. This section shall be known as the *Krome Memorial Institute*. It shall be presided over by a fourth vice-president who shall be elected by ballot at each annual meeting by the members in attendance at the Institute. The fourth vice-president shall be an ex-officio member of the Executive Committee.

# By-Laws

1. The Society shall be co-extensive with the calendar year, and the annual dues of members shall be two dollars.

2. All bills authorized by the Society or its Executive Committee, for its legitimate expenses, shall be paid by the Secretary's draft on the Treasurer, O. K.'d by the President.

3. The meetings of the Society shall be devoted only to Horticultural topics, from scientific and practical standpoints, and the presiding officer shall rule out of order all motions, resolutions and discussions tending to commit this Society to partisan politics or mercantile ventures.

4. All patrons and life membership dues and all donations, unless otherwise specified, shall be invested by the Treasurer in United States bonds. Only the interest in these bonds shall be available for payment of the current expenses of the Society. Perennial membership dues shall be placed on deposit at interest by the Treasurer. Only two dollars and the interest from each perennial membership fee shall be available for use in payment of current expenses of the Society during any particular year.

# List of Members

## HONORARY MEMBERS

Fairchild, Dr. David, Coconut Grove, Fla.
Haden, Mrs. Florence P., Coconut Grove, Fla.
Hart, W. S., Hawks Park, Fla.
Hubbard, E. S., Federal Point, Fla.
Hume, H. Harold, Gainesville, Fla.
Lipsey, L. W., Blanton, Fla.
Rolfs, P. H., Gainesville, Fla.
Shaw, Miss Eleanor G., Gainesville, Fla.
Skinner, L. B., Dunedin, Fla.
Stevens, H. B., DeLand, Fla.
Wilson, Lorenzo A., Jacksonville, Fla.

## PATRON MEMBERS

### COMPANIES

American Agricultural Chemical Co., Jacksonville, Fla.
American Fruit Growers, Inc., Orlando, Fla.
Angebilt Hotel Co., Orlando, Fla.
Armour Fertilizer Works, Jacksonville, Fla.
Buckeye Nurseries, Glen St. Mary, Fla.
Chase & Co., Orlando, Fla.
Coral Reef Nurseries Co., Homestead, Fla.
Deerfield Groves Co., Wabasco, Fla.
Deering, Chas., Miami, Fla.
Exchange Supply Co., Tampa, Fla.
Exotic Gardens, Miami, Fla.
Florida Citrus Exchange, Tampa, Fla.
Florida East Coast Hotel Co., St. Augustine, Fla.
Florida Grower Publishing Co., Tampa, Fla.
The Fruitlands Co., Lake Alfred, Fla.
Glen St. Mary Nurseries Co., Glen St. Mary, Fla.
Gulf Fertilizer Co., Tampa, Fla.
H. G. Hastings Co., Atlanta, Ga.
Hillsboro Hotel, Tampa, Fla.
Klemm, A. M., & Sons, Winter Haven, Fla.
Lake Garfield Nurseries Co., Bartow, Fla.
Manatee Fruit Co., Palmetto, Fla.
Mills, The Florist, Jacksonville, Fla.
Nocatee Fruit Co., Nocatee, Fla.
Oklawaha Nurseries Co., Inc., Lake Jem, Fla.
Peninsular Chemical Co., Orlando, Fla.
J. Schnarr & Co., Orlando, Fla.
Southern Crate Manufacturers Assn., Jacksonville, Fla.
Thomas Advertising Service, Jacksonville, Fla.
Van Fleet Co., Winter Haven, Fla.
Wilson & Toomer Fertilizer Co., Jacksonville, Fla.

### INDIVIDUALS

Beach, John B., West Palm Beach, Fla. (Deceased.)
Gardner, F. C., Lake Alfred Fla.
Hart, W. S., New Smyrna, Fla.
Krome, W. J., Homestead, Fla. (Deceased.)
Rolfs, P. H., Gainesville, Fla.
Sampson, F. G., Boardman, Fla. (Deceased.)
Skinner, L. B., Dunedin, Fla.
Taylor, John S., Largo, Fla.

## LIFE MEMBERS

Albertson Public Library, Orlando, Fla.
Allenbrand, Alfred, Box 228, Frostproof, Fla.
Alderman, A. D., Bartow, Fla.
Anderson, Frank K., Altamonte Springs, Fla.
Andrews, C. W., John Crerar Library, Chicago, Illinois.
Baltram, Francisco, Monerey, N. L., New Mexico.
Barber, C. F., Macclenny, Fla.
Bartlett, A. F., St. Petersburg, Fla.
Bartlum, W. Leonard, Fla. Agricultural Supply Co., Orlando, Fla.
Berger, E. W., Gainesville, Fla.
Berger, Mrs. E. W., Gainesville, Fla.
Bouis, Clarence G., P. O. Box 6, Ft. Meade, Fla.
Bringman, M. S., Waterbury Hospital, Waterbury, Conn.
Britt, John F., Ft. Pierce, Fla.
Carnegie, Mrs. T. M., Fernandina, Fla.
Champlain, A. E., R. F. D. No. 1, Palmetto, Fla.
Chase, Joshua C., Winter Park, Fla.
Chidester, D. D., 446 Painter Ave., Whittier, Cal.
Christiancy, Cornelius, Port Orange, Fla.
Clement, Waldo P., Georgiana, Fla.
Conner, Wayne E., New Smyrna, Fla.
Cook, R. F., Leesburg, Fla.
Cornell, H. E., Winter Haven, Fla.
County Agricultural Agent, Orange County, Orlando, Fla.
Crutchfield & Woolfolk, Pa., Produce Building, Pittsburgh, Pa.
Drew, Prof. Wm., Eagle Lake, Fla.
Dunedin Public Library, Dunedin, Fla.

Ellsworth, W. J., Blanton, Fla.
Emerson, Geo. D., Coconut Grove, Fla.
Fairchild, Dr. David, Coconut Grove, Fla.
Fairchild, Mrs. David, Coconut Grove, Fla.
Fugazzi, John, care of Fugazzi Bros., Clearwater, Fla.
Gifford, John, Coconut Grove, Fla.
Haden, Mrs. Florence P., Coconut Grove, Fla.
Hakes, L. A., Winter Park, Fla.
Hampton, B. M., New Port Richey, Fla.
Hastings, H. G., 16 West Mitchell St., Atlanta, Georgia.
Henricksen, H. C., Box 1045, Eustis, Fla.
Hentz, W. B., Winter Haven, Fla.
Herff, B. Von, Weygrasse 5, Vienna 3, Austria.
Hernandez, Pedro M., 108 Cienfuegos, San Fernando, Cuba.
Hollingsworth, G. S., Arcadia, Fla.
Hubbard, E. S., Federal Point, Fla.
Hume, H. Harold, Gainesville, Fla.
Iowa State College Library, Ames, Iowa.
Johnston, S. W., DeLand, Fla.
Kimball, Geo. N., Canaveral, Fla.
Lassen, H. C., Bean Spray Pump Co., San Jose, California.
Lauman, G. N., Ithaca, N. Y.
Leonard, George V., Hastings, Fla.
Lyons, Chas. W., care Lyons Fertilizer Co., Tampa, Fla.
Martin, A. Wm., Box 36, Sebastian, Fla.
Mackay, Alexander, Glencruitten, Oban, Argyl-shire, Scotland.
McCarty, B. K., Eldred, Fla.
McCarty, Mrs. C. T., Eldred, Fla.
Merrick, Geo., Coral Gables, Fla.
Merritt, Dr. J. C., 297 Sherman St., St. Paul, Minnesota.
Meyer, Carl, 2144 Slane Ave., Norwood, Ohio.
Michael, A. B., Wabasso, Fla.
Miller, H. K., Monticello, Fla.
Morley, John, Lake Alfred, Fla.
Moses, Wallace S., Palm Beach, Fla.
Mountain Lake Corporation, Lake Wales, Fla.
Myer, H. Van W., Coconut Grove, Fla.
Neville, H. O., Lonja Del Commercio, 542, Havana, Cuba.
O'Byrne, F. M., Lake Wales, Fla.
Ohmer, C. J., West Palm Beach, Fla.
Olivebaum, J. E., 7216 Clinton Ave., Cleveland, Ohio.
Pennock, Henry S., Jupiter, Fla.
Pike, W. N., Blanton, Fla.
Porcher, E. P., Cocoa, Fla.
Porcher, Mrs. E. P., Cocoa, Fla.
Prange, Mrs. Nettie M. G., Orlando, Fla.
Raulerson, J. Ed., Arcadia, Fla.
Reasoner, N. A., Oneco, Fla.
Reid, W. C., Largo, Fla.
Ricketson, Mrs. M. C., "Grayfield," Fernandina, Florida.
Rolfs, Prof. P. H., Gainesville, Fla.
Sample, J. W., Haines City, Fla.
Sandlin, A. R., Leeesburg, Fla.
Schuman, Albert, Sebastian, Fla.
Sellards, Dr. E. H., State Geologist, Austin, Texas.
Shepherd, Louis H., P. O. Box 175, DeLand, Fla.
Stanton, F. W., Dock and Walnut Sts., Philadelphia, Pa.
Stevens, Edmund, Verge Alta, Porto Rico.
Strauss, J. E., Plant City, Fla.
Stuart, L. E., Montemorelos, Mexico.
Taylor, J. S., Jr., Largo, Fla.
Thomas, Jefferson, Gainesville, Fla.
Towns, Thomas R., Holguin, Cuba.
Trelease, Wm., University of Illinois, Urbana, Ill.
Trueman, R. B., Jacksonville, Fla.
Wilson, Lorenzo A., Jacksonville, Fla.
Wirt, E. L., Box 144, Babson Park.
Yothers, W. W., Orlando, Fla.

## CONTINUING MEMBERS

Cleveland Public Library, 325 Superior Ave., N. E., Cleveland, Ohio.
Library Citrus Experiment Station, Riverside, California.
Library, Florida Agricultural Experiment Station, Gainesville, Fla.
Library, U. S. Department of Agriculture, Washington, D. C.

## PERENNIAL MEMBERS

Atwood Grapefruit Company, 1931-35, Manavista, Fla.
Avcrigg, Geo. B., 1935-39, Winter Haven, Fla.
Babson Park Citrus Growers Assn., 1932-36, Babson Park, Fla.
Bartlett, Merrill, 1100 First Nat.-So. Line Bldg., 1934-35, Minneapolis, Minn.
Billings, H. G., 1934-38, Lowell, Fla.
Case, H. C., 1935-36, Ft. Myers, Fla.
Daetwyler, M. J., 1935-39, Orlando, Fla.
Dixie Lime Products Co., 1932-36, Ocala, Fla.
Edison, Mrs. Thomas A., 1931-35, Seminole Lodge, Ft. Myers, Fla.
Fenton, Alfred, 1935-36, 1104 Second Nat. Bank Bldg., Houston, Texas.
Florida Brogdex Distributors, Inc., 1932-36, Dunedin, Fla.

Florida Citrus Machinery Company, 1932-36 Dunedin, Fla.
Geier, P. A., 1934-38, 540 E. 105th St., Cleveland, Ohio.
Greenamyer, A. G., 1935-39, 302 Highland Ave., Buffalo, N. Y.
Hatch, H. B., 1935-36, Dunedin, Fla.
Hoenshel, Paul M., 1934-35, Port Mayaca, Fla.
Holtsberg, Fred, 1931-35, Ft. Pierce, Fla.
International Fruit Corp., 1931-35, Citrus Exchange Bldg., Tampa, Fla.
Jackson Grain Company, 1934-35, Tampa, Fla.
Klemm, A. M., & Son, 1934-36, Winter Haven, Fla.
Lewis, E. L., 1935-36, North Easton, Mass.
Lyons, C. W., 1934-36, Lyons Fertilizer Co., Tampa, Fla.
Manatee Fruit Company, 1934-35, Palmetto, Fla.
Manatee Hammock Fruit Company, 1934-38, Manatee, Fla.
Meyer, Carl, 1935-39, 2144 Slane Ave., Norwood, Ohio.
Michael, A. B., 1935-36, Wabasso, Fla.
Mowery, John N., 1934-36, 100 Barber Ave., Worcester, Mass.
Orange County Citrus Sub-Exchange, 1931-35, Box 771, Orlando, Fla.
Phillips, Dr. P., and Sons, 1931-35, Orlando, Fla.
Rico Tropical Fruit Co., 1931-35, Garrochales, Porto Rico.
Robins, Mrs. Raymond, 1934-36, Chinsegut Hill, Brooksville, Fla.
Skinner, F. L., 1934-35, Dunedin, Fla.
Snodgrass, William, 1934-35, South Clermont, Florida.
Spencer, A. P., 1934-36, Gainesville, Fla.
Swann, Tom B., 1931-35, Winter Haven, Fla.
Traub, Dr. H. P., 1935-36, Box 1058, Orlando, Fla.
Vissering, Norman H., 1934-35, Babson Park, Fla.
Walker, Eli C., 1934-36, Vero Beach, Fla.
Weinschenck, G., 1933-37, 109 Av. Rio Branco, Rio de Janeiro, Brazil.
Wheaton, Thos. B., 1934-35, Stauffer Chemical Co., 2011 Forbes St., Box 567, Jacksonville, Fla.
Wilson & Toomer Fertilizer Company, 1935-39, Jacksonville, Fla.
Winter Garden Ornamental Nurseries, 1934-35, Winter Garden, Fla.
Wolf, Dr. Frederick A., 1935-36, Duke University, Durham, N. C.
Woltz, James M., 1934-36, 362 Lora Ave, Youngstown, Ohio.

## ANNUAL MEMBERS IN STATE

A. & W. Bulb Co., Clearwater.
Abbott, Prof. Chas. E., Prof. of Horticulture, U. of F., Gainesville.
Adair, J. O., 408 N. 1st St., Lake Wales.
Adams' Groves, Lake Alfred.
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Anderson, C. P., Box 11, Avon Park.
Anderson, Miss Frances M., San Mateo.
Anderson, J. E., Terra Ceia.
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Bahers, I. F., Box 2203, W. Palm Beach.
Bahrt, Dr. G. M., Box 629, Orlando.
Bailey, E. R., Sanibel Packing Co., Sanibel.
Barber, B. B., Clearwater.
Barker, Geo. S., St. Austell Groves, Elfers.
Barnett, W. L. E., Box 153, Mt. Dora.
Barney, J. W., Bradenton.
Barns, Judge Paul D., Circuit Court, Miami.
Barrow, David C., DeSoto Nurseries, DeSoto City.
Bartlum, W. Leonard, Fla. Agric. Supply Co., Orlando.
Baskin, J. L., Box 1051, Orlando.
Bass, C. A., 36 N. W. 32nd St., Miami.
Bazemore, J. F., Box 1235, Winter Haven.
Beach, Rex E., Box 1267, Sebring.
Beckler, W. A., Box 1657, Sarasota.
Beckstrom, Ross, Soil-Ade, Inc., Miami.
Bennett, Harry W., China-Tung Oil, Inc., Gainesville.
Berry, James R., Waverly.
Beymer, A. S., Box 1182, Winter Haven.
Bitte, Ernest C., Route 1, Box 154, Homestead.
Blackmon, G. H., Experiment Station, Gainesville.
Blandford Nurseries, Lake Jem.
Boyd, E. M., Eagle Lake.
Boyd, F. E., 521 Richmond St., Orlando.
Brock, G. R., Cocoa.
Brockway, Capt. E. K., Clermont.
Brooks Properties, Inc., Box 363, Homestead.
Brooks, Chas. I., 2272 S. W. 11th Ter., Miami.
Brooks, J. R., Homestead.
Brown, B. E., DeLand.
Brown, Earl W., DeLand.
Brown, L. H., Ft. Lauderdale.
Brown, Merle R., Box 1294, Winter Haven.
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Burt, Frederick N., DeLeon Springs.
Burton, R. P., Leesburg.
Cain, J. C., Box 2225, Gainesville.
Camp, Dr. A. F., Experiment Station, Gainesville.
Campbell, C. W., Dunedin.
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Chase, Joshua C., Winter Park.
Chase, Randall, Sanford.
Chase, S. O., Box 291, Sanford.
Citrus Grove Development Co., Babson Park.
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Cocke, John W., Jr., Box 209, Lakeland.
Cody, Lydia S., Babson Park.
Cody, Frank L., Babson Park.
Coffee, Fred, Armour Fert. Works, Jacksonville.
Coker, John A., Jr., Vero Beach.
Collins, Paul, Haines City.
Commander, Mrs. Rose B., 2906 Parkland Blvd., Tampa.
Compton, John C., Box 1229, Orlando.
Coolidge, J. W., Route 1, Ft. Pierce.
Coral Reef Nurseries Co., Homestead.
Corrigan, Francis, Crescent Poultry Farms, Bradenton.
Corsa, John, Vero Beach.
Cox, Geo. O., Cocoa.
Crant, Jethro, Vero Beach.
Crosby, W. J., Citra.
Currier, A. H., 2300 Brevard Road, St. Petersburg.
Curry, J. Reed, Fla. Citrus Exchange, Tampa.
Dancy, R. C., 2514 Prospect Road, Tampa.
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DeBusk, E. F., Gainesville.
Dowdell, R. S., Plant City.
Dowling, Paul M., 444 Lake St., Orlando.
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Doyle, James B., Box 935, DeLand.
Dreka, G. A., DeLand.
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Dunne, Jesse H., San Antonio.
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Eddy, Miss Bertha, Mt. Dora.
Eddy, Geo. S., Winter Park.
Eddy, Joseph T., Box 476, Winter Park.
Edsall, Henry J., The Ensley Grove, Bradenton.
Edsall, R. S., Box 61, Wabasso.
Emanuel, W. Lee, Box 1485, Orlando.
Erck, Theodore A., Astatula Grove, Leesburg.
Evans, H. H., Drawer 1100, Orlando.
Evans, John H., Jr., Box 535, Melbourne.
Evans, W. E., County Agric. Agent, Sarasota.
Eve, W. R., Jr., Box 1432, Orlando.
Farrington, J. W., DeLand.
Fearington, Paul M., DeLand.
Fifield, W. M., U. of F. Sub-Tropical Exp. Station, Homestead.
Florence Citrus Growers' Ass'n, Florence Villa.
Florida Brogdex Distributors, Inc., Dunedin.
Florida Citrus Exchange, Tampa.
Floridagold Citrus Corp., Lake Alfred.
Floyd, Bayard F., Davenport.
Floyd, Mrs. Bayard F., Davenport.
Floyd, Maj. W. L., U. of F., Gainesville.
Food Machinery Corp., Dunedin.
Freeman, R. E., c/o Lyons Fertilizer Co., Tampa.
Frey, John, Rockledge.
Fuller, William Allison, Cocoa.
Futch, Ivey E., Box 184, Lake Placid.
Galliver, Mrs. L. C., Tavares.
Gardner, F. C., Lake Alfred.
Gardner, Mrs. F. C., Lake Alfred.
Garrett, Chas. A., Route 1, Box 104, Kissimmee.
Garnett, Irl B., Hypoluxo.
Gessner, Peter, Box 156, DeLand.
Gilliland, G. E., DeLand.
Gladwin, R. R., Ft. Pierce.
Gleason, Miss Flavia, St. Home Dem. Agent, Tallahassee.
Gobel, Louis E., Box 568, Orlando.
Gocio, H. G., Sarasota.
Gomme, Wm., Box 540, Clearwater.
Goodwin, J. C., St. Nursery Inspector, Gainesville.
Grace, W. E., Ft. Pierce.
Grant, A. J., Dunedin.
Graves, J. Hubert, Wabasso.
Griffin, J. A., Exchange Nat'l Bank, Tampa.
Gulf Fertilizer Co., Tampa.
Hackney, G. T., Ft. Pierce.
Hadsell, D. W., Box 907, Orlando.
Hammerstein, C. P., Hollywood.
Harley, Mrs. Hugh J., DeLand.
Harris, Louis, Vero Beach.
Hartt, E. W., Avon Park.
Hatch, A. C., DeLand.
Hawkins, H. E. C., Fla. E. Coast Ry., St. Augustine.
Hayman, W. P., Bartow.
Haynes, Bayless W., Wilson & Toomer Co., Jacksonville.
Heist, Jno. R., Box 464, St. Augustine.
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Hiatt, S. W., Box 779, Jacksonville.
Highfill, L. R., Cocoa.
Hill, A. M., Jr., Box 1123, Vero Beach.
Hodges, Senator W. C., Tallahassee.
Hodnett, J. Victor, Auburndale.
Holland, Frank, Box 398, Winter Haven.
Horne, W. N., Bonita Springs.
Howells, H. E. C., Winter Haven.
Hughes, Dr. R. E., 823 Magnolia Ave., Orlando.
Hunt, Chas. M., Lake Wales.
Hunt, D. A., Lake Wales.
Hutchinson, W. A., Box 1021, Orlando.
Ingram, Dr. L. C., Box 1711, Orlando.
International Fruit Corp., Box 1138, Tampa.
Irey, Julian, Route 1, Box 26-B, Orlando.
Jackobsen, Ole, Ft. Pierce.
Jackson, C. J., Eustis.
Jackson, Miss Kate V., 821 S. Rome Ave., Tampa.
Jacocks, A. J., Box 1434, Winter Haven.
Jarvis, D. M., Box 453, DeLand.
Jefferies, J. H., Lake Alfred.
Jernigan, W. P., Box 27, Monticello.
Johnson, Mrs. Jack, Largo.
Jones, H. S., Vero Beach.
Jordahn, A. C., Box 292, Coconut Grove.
Kasal, R., Fruitland Park.
Keenan, Edw. T., Soil Laboratory, Frostproof.

Kellar, H. J., Dunedin.
Kersey, Grant, Clearwater.
Kime, Chas. D., Box 22, Orlando.
King, Batty, Estero.
King, Mrs. Frank O., Kissimmee.
Kinney, Roy L., Fellsmere.
Kirk, E. B., DeLand.
Kirkhuff, W. O., Mgr. Bradenton Citrus Growers' Ass'n, Bradenton.
Kirkland, L. P., Auburndale.
Kissimmee Citrus Growers' Ass'n, Box 411, Kissimmee.
Klingensmith, James L., Vero Beach.
Knight, Peter O., Tampa.
Knox, L. B., Ormond Beach.
Koblegard, Ruhl W., Box 1116, Ft. Pierce.
Krome, Mrs. William J., Homestead.
Krome, William H., Homestead.
Kunny, C. S., 5522 N. W. 12th Ave., Miami.
Kuntz, W. A., Lake Alfred.
Larsson, Jonas, R. D. No. 1, Box 27, Apopka.
Larson, Nels, Vero Beach.
Law, Percy, Sec'y Mapes Formula & Guano Co., Jacksonville.
Lawton, J. G., Bartow.
Lester, H., Plymouth.
Lewis, H. F., Terra Ceia.
Lewis, Mrs. W. H., Largo.
Lines, Earl, Fla. Citrus Exchange, Tampa.
Lipscomb, S. F., Bartow.
Logan, J. H., County Agent, Bradenton.
Loomis, Burdett, Jr., Pierce.
Looney, S. L., Fla. Citrus Exchange, Tampa.
Lord, E. L., Box 757, Winter Haven.
Lord, R. P., Jennie Jewel Drive, Orlando.
Loudon, Hugh R., Babson Park.
Lyons Fertilizer Co., Tampa.
McBride, H. E., DeLand.
McCabe, P., San Antonio.
McCormick, Holland, Ft. Myers.
McLain, L. Rogers, 2702 Jettin Ave., Tampa.
McNeill, Walter, Hollingsworth Road, Lakeland.
Mabson, H. B., Lake Region Hotel, Winter Haven.
Maher, W. J., Maher's Dept. Store, Vero Beach.
Malone, T. E., Odessa.
Marks, H. A., Box 273, Orlando.
Martell, James A., Ft. Pierce.
Martin, Mrs. Ulrica E., Redland.
Martin, R. E., Dunedin.
Matheson, Hugh M., 418 S. W. 2nd Ave., Miami.
Mathews, E. L., Plymouth.
Mathias, A. C., Lake Wales.
Maxcy, L., Inc., Frostproof.
Mayaca Corp., The, Port Mayaca.
Mead, Theodore L., Oviedo.
Meffert, W. H., Fla. Lime Co., Inc., Ocala.
Melvin, C. T., Box 2721, Tampa.
Mercer, M. T., 3624 Royal Palm Ave., Coconut Grove, Miami.
Michael, B. M., Wabasso.
Minton, O. C., Vero Beach.
Montgomery, Col. R. H., Coconut Grove, Miami.
Monsalvatge, R. F., Citrus Improvement Co. Sanford.
Morley, J. N., Lake Alfred.
Morrell, P. C., Avon Park.
Morrison, Reid, DeLand.
Morse, Geo. A., Babson Park.
Morton, J. C., Auburndale.
Mosher, E. Raye, DeLand.
Mothern, H. H., Winter Haven.
Mouser, W. H., & Co., Orlando.
Mowry, Harold, Gainesville.
Muersch, C. G., Box 1592, Orlando.
Muller, Paul, Box 993, Ft. Pierce.
Myers, Harold W., Bartow.
Nash, Mrs. Leo, Box 1087, Winter Haven.
Negus, C. R., Ft. Pierce.
Neller, J. R., Everglades Experiment Station, Bellglade.
Nelson, J. D., Route 2, Box 56, Ft. Pierce.
Newell, Dr. Wilmon, Gainesville.
Noble, C. B., 1460 N. Grove St., Gainesville.
Nordman, Ferd, New Smyrna.
Norton, James S., Box 589, Lakeland.
O'Byrne, Mrs. Frank, Lake Wales.
O'Kelley, E. B., Agric. & Industrial Agt., A. C. L. Ry. Co., 18 Jefferson St., Jacksonville.
Painter, R. R., Micco.
Palmer, H. W., Fruitland Park.
Palmer, J. C., Windemere.
Palm Harbor Citrus Growers' Ass'n, Palm Harbor.
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Rolfs, Miss Clarissa, Gainesville.
Ronald, T. G., Cocoa.
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PROCEEDINGS

OF THE

FLORIDA STATE HORTICULTURAL SOCIETY

VOL. XLVIII PRINTED 1935

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# Forty-Eighth Annual Meeting of the Florida State Horticultural Society

One of the nicest compliments we have heard of the Forty-eighth Annual Meeting of the Society held this year in Vero Beach on April 9, 10 and 11, was a statement by an older member that this meeting was more like the old time meetings than any held in recent years. The sessions, particularly those of the Krome Memorial Institute, were characterized by more discussions from the floor. There was an active interest in the papers and the addresses.

Thanks to Waldo Sexton and the genial secretary of the Vero Beach Chamber of Commerce, Mr. G. E. Thatcher, under leadership of whom the various entertainment features were staged, the members were royally entertained. There was a cordial hospitality that made everyone feel at ease. Local entertainment numbers were interspersed in every program, and we are much indebted to those who took part. These numbers make a pleasing break in the programs and give the listeners a little rest from the monotony of the regular program and enables them the better to follow the speakers. The entertainment program of this year is published in full in these Proceedings.

**McKee Jungle Gardens**

One of the pleasing features of the Vero Meeting was the opportunity afforded to visit the McKee Jungle Gardens, as guests of Mr. McKee and his associates. The landscaping, the variety of sub-tropical plant life, and the natural setting is beautiful, impressive and a work of art. Every resident of Florida as well as every winter visitor should see the Gardens, not just once, but many times, to appreciate their natural beauty. We refer our readers to the article, "McKee Jungle Gardens, an Outstanding Beauty Spot," by Mr. A. H. Andrews on page XVII of this book, for an excellent description of them.

Mr. Hume stated: "No one should miss the opportunity to visit these gardens. I look upon the Jungle Gardens as a preferential location for a certain cross-section of the State. I know the person who comes from Massachusetts or Connecticut to Florida comes to see some plant monstrosity from Java that my friend, Fairchild, may have picked up in his ramblings or from the Amazon or New Zealand or Australia. I have never seen a plant lover yet that wasn't interested in coming to see something that came from the other side of the world. But the thing that appeals to me about the Jungle Gardens is that here are bits of Florida itself, unaided, unchanged and as Nature made them. I think that anyone who has the opportunity to visit these Gardens certainly should not miss it, if you are interested in the things that really make Florida."

**Fruit Juice**

Another pleasing innovation was the serving of orange and grapefruit juice in the lobby of the Vero Theater through the courtesy of the American Fruit Growers, Inc. The juice was served by two beautiful and gracious young ladies, and the best evidence of appreciation was the many members gathered about the bowls at all hours during the sessions.

**Flower Shows**

The Society greatly appreciates the action of the Indian River Garden Club in delaying their Annual Flower Show so that it could be held coincident with our meeting. It was a beautiful and well arranged Show. Staged in the same building

and at the same time was the *Tenth Annual Florida Rose Show* under the direction of Mrs. M. T. Gordon, Jr. We are much indebted to the ladies for the beautiful display of flowers, that equalled if not surpassed any display at our meetings in recent years.

Staged at the same place was an exhibit of Indian River Fruit by local growers and packers. This exhibit attracted much attention and favorable comment.

**Rose Meeting**

The Tenth Annual Meeting of the Florida Rose Society was held in Hotel Vero DelMar on Wednesday afternoon with Mr. R. H. Ellis of Orlando as presiding officer. A very interesting program was presented to a small but appreciative audience. The Proceedings of this Society are published separately and can be obtained from N. A. Reasoner, Treasurer, at Oneco, Florida.

**Our Semi-Centennial**

The Fiftieth Annual Meeting of the Florida State Horticultural Society is, by vote taken at this year's session, to be held in Ocala in the spring of 1937. It is quite fitting that the Society should hold its meeting here in its semi-centennial year, because it was in the Ocala House in 1888 that the Society held its organization meeting.

A large committee has been appointed to arrange for a proper observance of this event. The development of horticulture in Florida is practically co-incident with the life of the Florida State Horticultural Society and this organization has been a leading agency in bringing horticulture in the State to its present high level.

All branches of horticulture in Florida will be invited to participate in the festivities and it is anticipated that this will be the beginning of a new era of broader and greater usefulness of the organization to the State.

**McKee Jungle Gardens Attendance Cup**

Thanks to the interest and magnanimity of Waldo E. Sexton and the McKee Jungle Gardens, the Horticultural Society is able to offer a loving cup to the Community having the largest number of members in attendance at its Annual Meetings. It is hoped, through the offering of this cup, to stimulate local interest in the various horticultural communities in the State, in maintaining membership and in attendance. The community that has the largest numbers in attendance during three successive years will retain the cup as a trophy.

DeLand had the largest delegation present at the 1935 meeting and the cup was graciously received in behalf of this community by Secretary Gilliland of the DeLand Chamber of Commerce.

**1936 Meeting Place**

DeLand was also chosen as the place for the Forty-ninth Annual Meeting to be held in the spring of 1936. The date of meeting will be selected by the Executive Committee at its meeting in January, 1936.

**Necrology**

Again, the Grim Reaper has taken its toll from our midst. Among the prominent members who have passed on are Fred A. Rundel, M. M. Bass, H. Guy Nickerson, P. K. Yonge and others.

# *McKee Jungle Gardens an Outstanding Beauty Spot*

**A. H. Andrews, Estero**

Somber, winding vistas of Nature's cathedral aisles; massive columns of lofty oaks and native palms entwined with clinging vines and garlanded with moss and epiphytes; bright sunlight filtering down through inarched tree tops forming an ever shifting filigree pattern of lights and shadows on the forest floor; dark pools where variegated water lilies raise their heads above green masses of lily pads; disintegrating, prostrate trunks of forest monarchs—mute evdience of departed grandeur; solitude and stillness, broken only by faint sound of rippling water and occasional note from feathered choir o'erhead; the forest primeval, preserved unspoiled from the devastating hand of man; a quiet eddy, as it were, close by the mad, onrushing traffic stream, where one may relax from nervous tension and find composure and rest in Nature's sanctuary.

Such were my impressions when visiting for the first time the McKee Jungle Gardens on Wednesday, April 10th, while attending the annual meeting of Florida State Horticultural Society held at Vero Beach. For the pleasure of a personally conducted tour of this outstanding Florida beauty spot I am indebted to the courtesy of Mr. Waldo E. Sexton, well known developer, and part owner in the Jungle Gardens. Also comprising the party were Prof. P. H. Rolfs and daughter of Gainesville. Dr. Rolfs will be recalled by many as one time head of the experimental station at Gainesville who resigned his position to work with the Brazilian Government and has returned to this country after some thirteen years' absence.

McKee Jungle Gardens are situated some four miles south of Vero Beach, fronting on the east side of Dixie Highway, the tract comprising some eighty acres of tropical jungle, consisting largely of giant oaks and native palms, together with varieties of East Coast jungle vegetation, more or less strange or unknown to our lower West Coast hammocks.

A semi-circular drive leads in from the Dixie Highway, affording parking space for visitors. In the foreground are slatted plant sheds and ornamental trellised entrance, flanked by a rustic lunch room and souvenir shop. Across the entire front are trained rampant growing flowering vines, with base plantings of various ornamental plants.

Entrance to the grounds is through a long trellised floral archway, with path bordered by bright crotons, dracaenas and flowering shrubs, the whole framing in a distinct forest vista of indescribable beauty. For the most part, only the native forest vegetation prevails in the jungle, though here and there vacant spaces have been filled and woodland paths more definitely outlined by introduction of occasional exotic plants which contribute much to the interest of visiting tourists, but blend well with the wild surroundings. Among the many noted were Azaleas, Kapok Tree, Traveler's Tree, Corkscrew Pine (Pandanus), Mahogany, Sausage Tree, Breadfruit, Frangipani, Tea, Coffee, spides and a variety of palms.

A small stream flows through the jungle whose waters have been diverted into numerous shaded pools wherein may be seen Water Lilies of every conceivable shade and tint, ranging in size up to the giant Victoria Regia, one leaf of which is sufficiently large and rigid to support the weight of a small child. It is claimed that this collection of Water Lilies is the largest and most complete in the entire country.

Shaded woodland paths wind in and out around the lily pools in an intricate labyrinth in which all sense of direction is lost and were it not for signs at intervals one might wander about aim-

lessly for some time before finding his way out. Everything for the most part is as wild and rugged as Nature made it. The land is of slight elevation so that abundant moisture is present even through the dry season and its fertility is attested by the luxuriant forest vegetation.

In a remote part of the jungle are noted several thatched Seminole Indian huts adjoining a fenced enclosure wherein are a few deer and wild turkeys. Mr. Sexton stated that he engaged a small group of Indians to live on the place as an added attraction to tourists, but one day they left without notice. He declared there is absolutely no accounting for Seminole Indian ways.

A number of pheasants were once turned loose in the jungle, but shortly disappeared, possibly falling prey to wild animals which are known to inhabit the jungle, as a panther was recently seen in one of the pathways. Alligators may be seen here and there in the lily pools and are a never failing source of interest to visiting tourists.

Should you grow warm and thirsty in your meanderings through the jungle you will find a convenient rustic shelter where refreshing orange and grapefruit juice is served. There is also an excellent lunch room near the entrance gate where the wants of the inner man can be satisfied.

We were loath to leave this tropical woodland paradise, but the sun rapidly sinking toward the western horizon gave warning of the near approach of nightfall. Returning to the entrance gate by another route, our attention was called to a pathway bordered by two rows of thrifty Royal Palms, some fifteen feet or more in height. These palms, Mr. Sexton informed us, he bought as little spindling nursery trees but four years ago and set them out temporarily, thinking to sell them later. They have grown so amazingly that he decided to leave them as a permanent feature. I have seen no finer Royal Palms than these anywhere on the Florida East Coast.

For years it has been the dream of Mr. Waldo E. Sexton to preserve in all its pristine wild beauty a bit of this great coastal hammock for the enjoyment of this and coming generations. Some four years ago he interested in purchasing this eighty-acre tract Mr. Arthur McKee, a wealthy mining engineer of Cleveland, Ohio, the Jungle Gardens representing to date a total expenditure of more than $100,000.00. Mr. McKee rightly feels that after having expended so much money in initiating this wonderful park project for the benefit of the public, it should henceforth pay its own cost of upkeep. For that purpose an admission fee of $1.00 is charged and readily paid by visitors and tourists who feel that it is well worth the price.

Mr. Waldo E. Sexton, part owner and manager of McKee Jungle Gardens, a native of Indiana, has lived in Florida for over twenty years. Some years ago he promoted a great outstanding ocean front development project adjoining the town of Vero which is today one of the show places of that city. He is proprietor of a large dairy and owns a half interest in a wonderful 160-acre citrus grove. As is usual with most people of ability and accomplishment, he proved a most genial and intersting companion on acquaintance, to whom I am greatly indebted for many courtesies shown while attending the State Horticultural convention at Vero Beach.—From The American Eagle, April 25, 1935.

# PROCEEDINGS

OF THE

# *Florida State Horticultural Society*

## FORTY-EIGHTH ANNUAL MEETING

VERO BEACH, APRIL 9, 10 AND 11, 1935

## OPENING SESSION

Pres. John S. Taylor: We will come to order. This is the Forty-eighth annual session of the Florida State Horticultural Society. The invocation will be given by Rev. T. C. Baldwin.

## INVOCATION

**Rev. T. C. BALDWIN, Vero Beach**

## ADDRESS OF WELCOME

**Mayor Alex MacWilliams, Vero Beach**

*Mr. President and Members of the Florida Horticultural Society:*

On behalf of the citizens of Vero Beach, I extend to you a very hearty and sincere welcome. We people in Vero Beach and in Indian River County have a great interest in the work of this association that is holding its convention in our city, because we are absolutely dependent upon our citrus fruits for the development of our particular section. In other words, you people are the real developers of the State of Florida.

While we have a great many tourists in this city during the winter season, nevertheless, this city was founded upon the agricultural and horticultural production which we have. I was talking to one of the pioneers of this section just before coming over here tonight and I asked him this question, "When you first located here, how many groves were there in existence in this particular section of our state?" He told me that twenty-five years ago he did not belive there were more than fifty to sixty acres of grove. So in that time we have seen the development of a very vast acreage in grove and not only have we seen a large development in the groves, but we have seen the development of the biggest small city in the State of Florida, in Vero Beach.

To you people who are visitors let me say we are proud of one thing; that is, the people who have located here and have carried on. They have continued developing. I look out there in this

audience and I see men who are responsible for some of the biggest accomplishments which we can show those who visit here. I think all of you are going to enjoy your stay here and I want to say that anything anyone in this community can do to make your visit pleasant, just let us know. We have arranged for you to use the two golf courses. You can have the finest fishing in the State of Florida. Right off the shore we have one of the finest bathing beaches in the State and there are tennis courts—anything you want to do, we have it. We want you to enjoy yourselves.

Another thing is, don't judge Vero Beach by the few flowers you see on the stage tonight. Go over and visit the flower show in Exhibition Hall tomorrow. It will be a revelation to you. I think it is one of the most beautiful shows in the State. I want you to know that the people of Vero Beach and Indian River County appreciate your presence and we hope you will enjoy yourselves while you are here.

Any time you see an auto with a banner on it, hop in and tell them to take you anywhere you want to go. If you want any information, stop these fellows with the badges on and if you don't see any of them, ask the merchants. One of the principal by-words we have—and it is not a by-word, because it is sincere—is "Extend courtesies to the visitor." Believe me, we are happy to have you. I thank you.

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## RESPONSE TO ADDRESS OF WELCOME

**H. Harold Hume, Gainesville**

*Mr. President, Members of the Horticultural Society, Ladies and Gentlemen:*

On your behalf, I thank the mayor for his very gracious words of welcome. I think it is always well that in welcoming a guest the host should know whom he is welcoming. And, Mr. Mayor, may I say that this aggregation thinks well of itself. I think, too, as a member of the body, I may say for my associates that they are worthy. This society had grown old before Vero Beach started. May I call to your attention the fact that it was founded in 1888, April 10th, tomorrow, at 3:30 in the afternoon in the town of Ocala, in the Ocala Hotel, and it has had a continuous existence since that time. Forty-eight years ought to teach an individual some sense. There is the aggregation of common sense as it is represented in the horticultural estate today. Belonging to our organization at various times have been, I suppose, practically all the important horticulturists of the State. They have been the developers of many industries.

Practically every horticultural industry in the State began in a small way. Your citrus industry began about 1565 in a garden in St. Augustine. I can remember the start of the potato industry in Hastings. We have seen the bulb industry of the State put over. We have seen the calamities of 1895 and 1899, whereof was born the trucking industry of Florida. If you trace back the history of the organization, you will find different individuals at different times have played an important part. I may mention Dudley Adams, Lyman Phelps, E. S. Hubbard, E. H. Hart, who gave you the Valencia orange in the State of Florida; Wartman, Hoyt, Knox—they were some of the men who made this society and the society has passed through various vicissitudes.

I can remember Professor Rolf's telling me that when he first came to Florida and became associated with the agricultural station, he had to sneak out the back door to get to a Horticultural meeting. Today, I suppose the agricultural station is represented by a number of people on your program. So this Society has had a great deal to do with the development of agriculture.

There are two or three things I would call to your attention. Contrary to the horticultural societies of many states, this has never been commercialized. It has never been paid. It has never been subsidized. It has been a free lance, working continuously for the development of the State. It has been the clearing house and forum for discussion of those problems which particularly pertain to the growing of fruits and vegetables of the State.

There is one unfortunate thing about the problems which confront us in an agricultural way. No problem is ever disposed of; no difficulty is ever permanently put on the shelf and laid aside. Those old troubles are with us always, and new ones from time to time are added. Hence the need for an organization like this to assist in backing the things that are worth while in the horticultural life and development of the State, and we are holding now our forty-eighth annual meeting. Forty-seven years ago tomorrow our Society started. Those are the people you are entertaining, Mr. Mayor.

We appreciate your words of welcome sincerely. We are glad to be with you; we shall enjoy your entertainment as best we can, but this is a hard working body and how much we can take advantage of it I can't tell you.

## PRESIDENT'S ANNUAL ADDRESS

*Ladies and Gentlemen:*

I have great consolation and pride in the privilege and honor of convening the Forty-eighth annual meeting of the Florida Horticultural Society here in Vero Beach today. There is also a feeling of seriousness and responsibility attached to the almost half-a-century-old program of horticultural ideals sponsored by this Society.

Those pioneeers of 48 years ago, looking ahead through the years, pictured in their minds a statewide network of highways, of full grown cities, of farms and gardens and groves, all beautiful to behold. They had in mind also the parks and reservations which would be examples of beauty. It was their vision of fruits and flowers and shrubs and developed homelands and farms that gave both purpose and permanency to the program of this organization. It is our privilege today to "carry on" the good work which they began. A happy, contented people amid beautiful, healthful and prosperous surroundings is our goal.

Speaking horticulturally, there are present needs which might well commend our attention here in the good State of Florida, improvements in various ways to bring about a fuller production from off the thirty some million acres which now lie outside the cultivated areas. There is no doubt in my own mind but that in the field of fruits and vegetables there is plenty of room for a general education along the lines of gardening and farm possibilities throughout the State. Few people recognize or know fully what can be produced both commercially and in the home garden in different localities of the State. The very fact that Florida *fresh* vegetable, melon and berry production has grown to more than 60,000 carloads annually, with citrus production exceeding 70,000 carloads annually, and the additional fact that large corporations are now locating extensive canning enterprises within the State indicate only in a small way what could be done with the available productive acreage in the State.

Few people knew about avocados and papayas until recently. Now they are coming to be quite well known in many markets. Production will increase not only with these two items, but with a hundred more which have equally important sales advantages, such as endive, kale, broccoli, brussels sprouts, celery, tomatoes, okra, peppers, asparagus, cauliflower, cabbage, etc.

Take broccoli, for instance, among numerous fresh vegetables it is fast becoming a favorite on many hotel, dining car and home tables.

In the field of citrus, we face loss, I fear, unless seedless varieties of oranges, grapefruit and other citrus fruits are developed. Our Valencia and other late oranges are practically seedless. The same cannot be said of our early and mid-season oranges nor of our regular grapefruit, all of which have too many seeds to compete with seedless varieties, to which the American public has become well educated through a good volume of advertising and to which the public naturally extends a preference on account of greater convenience.

In the field of ornamental shrubs, vines and

flowers, it is fast becoming recognized that more hardy varieties are needed to withstand the periodical frost interruptions which frequently take heavy toll in damages.

Here are problems for our experimental laboratories, our nursery men, our county agents and various educational institutions. This Society would do well to name a committee to study improved varieties of fruits, vegetables and ornamental plants and bring in practical suggestions at the time of our fiftieth anniversary meeting.

All these suggestions are in harmony with the prospective new developments in scientific planning for home and community. And while the nation takes more and more to fresh fruits and vegetables, it is our opportunity and privilege here in Florida to convert more acres into useful production commercially as well as for home subsistence for our present population and for the thousands of additional families which we expect in the State in years to come.

I wish that the agricultural agencies of State and Federal governments would immediately plan, erect and equip small model subsistence homesteads of modest types in every community in this State, as examples, to show the great majority of our people just how the various soils and locations in Florida can be managed through a variety of cultivation and propagation to enable families to maintain themselves happily and prosperously. Small model sustaining homesteads for the average families, publicized and dignified to assist our own people and to attract other families from less favored regions throughout the North.

The Fiftieth meeting of the Society should be the occasion for rendering a history of past accomplishments and also for a future program. I commend these thoughts and ideas for your consideration.

## PLANT TRAILS IN SPAIN AND NORTH AFRICA

**Dr. Knowles A. Ryerson, Washington, D. C.**

To discuss plant hunting at any time is a rather more complicated process than perhaps you think. A plant expedition involves quite a number of things besides just landing somewhere and starting out to hunt plants. Those of you who enjoy the fun of collecting wild things in your own state know something about the preparation that goes even into that; and to do it abroad involves many other things.

It is an adventure in human understanding. You are going among strangers in custom, history, background and language. You go, very often, into areas where you are not particularly welcome. There was a time when an American would naturally assume he was welcome anywhere. If there ever was such a time, it is long since gone. In most of the out-of-the-way corners of the world now the very word "American" may be a liability rather than an asset; so that, in addition to plant knowledge, you need a sense of humor and a lot of tolerance if your mission is to succeed.

About this time every year, the office in Washington having to do with plant exploration becomes swamped with letters from high school and college students asking the qualifications of a plant explorer, assuming they will probably get a long list of special studies they must undertake before they can qualify. That is not the reply they get. After all, a chap who has graduated from a college of agriculture or some other institution has a foundation that can be built on and that can be checked as to how much he knows. We tell him there are two other things much more important than knowledge of plants, without which no man can be an explorer—first, rugged health, and, of equal importance in many cases, we tell them, a good sense of humor working twenty-four hours a day. That is something he can't get in college, though a college may de-

velop it, but no course can give it. So in going out to these out-of-the-way places, it is not just checking over your plant information to see whether you have the right kind of flora, but a lot of these other things, and along the way you find out a lot of things you may wish you had checked over personally.

Plant trails in Spain and North Africa could lead you most any way in such a large area. To compress in the short space of a period of an hour the work of four or five months means hitting the high spots. This is a Horticultural society. That has a bearing, because if you are out looking for alfalfa, as we were in this particular expedition, it would not interest you unless you happened to be a dairyman and were looking for something to succeed in Florida.

You are interested in fruits and plants. Instead of trying to make a Cook's cruise of the Mediterranean and touch every place that would be of interest, it is perhaps better to take a few and dwell upon them and you will carry away better pictures. This particular trip was taken five years ago, with several objects in view. One expedition was to study table grapes grown by Arabs. At that time we were still living under prohibition. The grape varieties had been developed out of wine varieties. No special effort had been made to go in for table varieties in any manner comparable to wine grapes during the old regime.

The Arabs surrounding the Mediterranean are dry by religion and are great grape growers. So they have been growing grapes for centuries. We were interested to find some that would grow ahead of the normal crop. For that purpose, we sent one of our group from the University of California on ahead. Mr. Westover and myself went over later, Mr. Westover looking for hardy types of alfalfa and myself interested in citrus fruits. We combined our work later. Just realize, it was a consolidated expedition and before the summer was over we covered considerable territory. We started in Spain, partly because there wild alfalfas there; partly because it was the period of the citrus season and we wished to make certain arrangements for later work.

Spain is a very fascinating place to spend many months in. We started out at Madrid because that's where you make diplomatic arrangements. I am strong for the Spanish system. You cannot find a man in his office before eleven o'clock in the summer time and when he goes home for lunch you can not find him any time. We would like to introduce that in this country, but haven't gotten very far with it. We don't live on a very sensible system in the United States. Part of the year we are in the tropics, yet we try to keep north temperate hours and kid ourselves we are doing efficient work, instead of sleeping through the middle of the day, as sensible people should. We are stubborn in our northern attittudes on some of these things. We have much to learn from these people living in the warm parts of the world.

There is much to see in Madrid from the plant line. It is in the center of Spain for strategic reasons. When you cross the frontier, you find the gauge of railroad changed to a narrower gauge road. No through trains can reach Madrid from the outside. It has beautiful art galleries and museums and public gardens that are modern. It is at that point we are to start this evening with our pictures.

Spain has a particular appeal to Florida, California and southern portions of the United States, because it was explored by the Spanish and their influence is shown all up and down the coast here. Architecturally we have a heritage there. We have this in our plants, especially our fruits, so it is interesting to go on through Spain and tie it up with what we have here at home.

(NOTE: Here the lights were turned out and the speaker showed slides of scenes in Spain and Africa, giving explanations of each.)

### CONCLUSION OF ADDRESS

Exploring for plants means bringing them back alive. We have to bring them back alive, but without the glamour of those that bring wild animals. But it does bring its satisfaction to the men who have been doing this sort of thing over a period of years and the period has been long as history goes in this country. It is the hardest agricultural activity ever started by the government. The first appropriation ever made

by any congress in this country for this work was the great sum of $1,000. It was in 1839 and was for the collection and introduction of useful seeds and plants from abroad.

So men have gone into the far corners of the world, trying to bring those things that make for a better and more useful life, profitable in a commercial sense, but more profitable in a greater sense.

Here at the end of the trail, we look to Florida for the creation of this sort of thing for all garden-lovers and plant-lovers to come and enjoy the best things the plant world has to give you.

## ORIENTAL PLANT EXCHANGE, WITH SPECIAL REFERENCE TO LITCHI AND CITRUS

**G. Weidman Groff**
**Professor of Horticulture, Lingnan University, Canton, China**

The address we have just heard by Dr. Rolfs, in which he has so interestingly recorded the influence of the lives of some well known men in the development of the horticulture of your state, reminds me of a debt of gratitude we, on the other side of the world, owe to some of these same men, particularly those of the federal government service. I am sure it will interest you to know that just as these pioneers in plant introduction in our own country have played a large part in the plant improvement of your state, so their influence is being felt in other parts of the world. I refer particularly to Dr. David Fairchild, who is with us tonight; to Dr. Walter Swingle who is America's outstanding Sinilogue in the plant field; to Dr. Frederick V. Coville, Dr. O. F. Cook, and others who have been great friends of China and keen students of her flora and agricultural problems. As these men have inspired and helped you, so they have stimulated those of us who are in foreign service.

The subject first assigned to me this evening was Horticulture in the Orient. The Orient, or even a small portion of it such as China, is far too large a geographical unit for the constructive thought of a short sketch such as this. Within the scope of that which I shall say to you tonight I can only hope to leave with you in outline: (1) the intense interest of the Orient in horticultural pursuit; (2) the genera in which China's chief subtropical fruit interests lie; and (3) something of the cultural methods and problems which the Orient has experienced in fruit production.

The primary subject of my remarks, however, is that of Oriental Plant Exchange, especially as related to China. The pictures which I shall later show are associated with this subject of plant exchange between China and the West as we of Lingnan University, representing both Chinese and American interests, are related to it. The object of my present sojourn in Florida is entirely connected with a study of your plant resources, particularly fruit and nut crops, with a view to the acquisition, suitable propagation, and transhipment of species and varieties desirable for introduction into South China. On the other hand I would assure you that in spite of all that has been done in plant exploration in China the areas of southeastern Asia have been barely scratched for new plants, and they contain numerous forms you still need to enrich the horticulture of your verdant and productive state.

The Chinese people intuitively believe that "'all within the four seas are brothers," particularly when it comes to the arts of peace, and of which horticulture is one of their most highly developed. We believe there is no field in which more lasting friendships can be established, within the state, within the nation, and within the world at large than in this field of plant interest and plant exchange. Here then is opportunity for reciprocal

relationships of immense import to both East and West: one contributing to the other not only in the actual transfer of living plant materials, but also in a study of ancient cultural methods, and in benefits which may be derived through modern scientific research.

I am aware that here in Florida of the present day when the average promotional plantsman thinks of China he first thinks of Wood or Tung Oil trees. This is truly one of China's great modern plant contributions to America, but there are many others, and there will be many more. My remarks this evening will be largely confined to this immensely fascinating subject of Oriental plant exchange as it is related especially to Lychee and Citrus, with also a little regarding Bamboo, in all three fiields of which we of Lingnan University are peculiarly fitted to make small measure of contribution to future world development; and for the culture of all of which the state of Florida seems well fitted in soil and climatic requirements.

In order to fully acquaint you with the regions of Asia from which our pictures are largely drawn, and in which our present interests largely lie, I should explain that China in area is larger than the United States; and has as diverse soil and climatic variations as we experience here in America. No doubt many of you have read the fascinating travels of Marco Polo. His land of Cathay has become popularly know in the West as all China. But this was not the concept of Marco Polo. He differentiated clearly between Cathay and Manzi, both lands of immense scenic beauty, but of vast contrasts. Marco Polo's Cathay extended from the cold, wind-swept desert expanse of northwest China, with its camels and caravan trains, well into the lower Yangtse teeming with life. With this area the Florida horticulturist has little in common. But Marco Polo's Manzi is the summer monsoon-favored hills of present-day China and Indo-China, covered with grains, grasses, and bamboo, and extends into the citrus and lychee fruit laden areas of the frostless coast of southern China. This land of Manzi, then, is the China we picture tonight. With the plant lore of this fascinating area you should be most thoroughly acquainted for the further advance of your own horticultural interests.

Southern China, of which Canton is the metropolis, was at one time a land of barbarians to the people of China proper, just as Florida was to the average American mind not so many years ago. But today this region is the center of China's hopes and aspirations; a sun-warmed area of ample rainfall where nature is generally kind, and where famines rarely occur. Chinese history records how Su T'ung-po, high official, poet, and essay writer of first rank in eleventh century China, was actually banished to this country, known as "Lingnan" or "South of the Range," because he had spoken disrespectfully of his Emperor. But of the marvelous fruits of this then slightly known area, developed at so early a date as this, Su T'ung po has left us many poems, no less than eight on the Lychee alone. In one of these he remarks, with that sense of humor so characteristic of the Chinese, and in words which heaped coals of fire upon the heads of his enemies (I quote from English translation):

"Beneath these green mountains where spring
rules the year,
Where Myrica and Loquat in season appear;
And feasting on Lychee—three hundred a day—
I shouldn't mind staying eternally here."

Horticulture in South China is not for the plantsman alone. Nor is it primarily a money making proposition. Horticulture in the Orient, particularly in China, relates to the best in life as expressed in the home, in literature, in health, as also in wealth—in commerce. Take for example this most interesting and important fruit of China, the Lychee, the most highly cherished and distinctive fruit of that great nation, which you here in Florida are only beginning to know. Chinese poets and essay writers have sung praises to this fruit for centuries. Chinese officials and gentry of the past and present day encourage the cultivation of these fruits by assembling and protecting parent trees of choice varieties, by disseminating information regarding cultural methods, and by encouraging the description of varieties. The importance of the Lychee in the eyes of the

Chinese is evidenced by the fact that there are more than a score of treaties on this important fruit by very famous Chinese authors, beginning with that of Ts'oi Seung in A. D. 1059, his Lychee P'u or Book being the first horticultural monograph extant, and extending to that of Wu Ying K'uei in 1826. Fellowship clubs in China are formed to enjoy and promote the Lychee. Two years ago this summer, in the heighth of the Lychee season at Canton, I travelled through pouring rain and over almost impassible roads to a famous hill Lychee district fifty miles distant from Canton. Here I sat with the Governor of China's most wealthy province, Kwangtung, with the Commissioner of Education, and the Director of the Bureau of Agriculture and Forestry, all of whom were enjoying a day's outing with the humble villagers of this renowned area, judging plates of Lychee, and eating to the full. These Lychee clubs, as also Lychee parks, have long been known in China. Let me quote briefly from Mr. Michael J. Haggerty's translation of Sung Chio's Lychee Club in the Ming Dynasty.

"The people of leisure in Wu and Yueh (which were two non-lychee producing regions of China) who hear of this fruit can enjoy it only with their ears, though the hearing of it makes them imagine they can see it, and causes their mouths to water so profusely that they wet their feet and are compelled to roll up the skirts of their robes, embarrassing them so that they do not know what to do.

"My friends of the same tastes as myself in the village are few, and their capacity for eating lychee is very small. Many times have I wanted to invite a number of friends to form a club. Accordingly on the 6th day of the 6th month we began to meet in the Tsui family garden, and we agreed to meet once every day until the lychee fruiting season was over. The by-laws of our club consisted of five articles. I was made director of the club. Though this fruit is a wonderful and mysterious thing, yet we are able to value, cherish, and also guard it by forming into a club those who have the same liking for it as ourselves.

"We will meet when the weather is fine. For a tent we will use the heavy shade. For a bath we will use the cold fountain. For a covering we will use clothing that the breezes blow through. For illumination we will use the cool moonlight. To mix with the lychee we will use dark blue wine. For relief from over eating we will use cold syrup. To verify statements concerning the lychee we will use the old records. To record our business we will use new poems.

"Although we are living in a foul, dusty world, still we are able to view the borders of the capital of the genii, and while our bodies dwell within a fiery city, our spirits roam throughout the cool vallies. Not only those people of leisure living in Wu and Yueh cannot gratify these longings, but that even famous historical personages (their names being given) could not compete with us is clear."

Thereafter follow the five by-laws of the Club, three and four of which I cannot refrain from quoting:

"(3) The club will meet in the morning and adjourn in the evening. At noon we will eat some vegetable congee and in the evening supplement this with several cups of clear broth. There will be no large vessels of strong rank meats to mar the refinement of our gatherings.

"(4) When about to separate each member must select a theme and a rhyme, and at the following meeting he must present his poem. If it is not finished he is punished by having three thousand fruits taken from him. At meeting time members will devote themselves to eating and drinking and not occupy themselves with poems and songs, but each following his own inclination may either take the tripod for warming tea, play chess, recline upon a pillow or mat, enjoy fragrant incense, chat, laugh, and not bother about anything else."

That is a digression from the subject of plant exchange, but I believe these few remarks relative to the all important fruit of China, the Lychee, leaves you with a feeling of that intense interest in horticultural pursuit which is a part of the lives of so many active officials, gentry, scholars, and business men of China. This intelligent concept is one of the three outstanding

features of Oriental horticulture I said I hope to give you in passing.

Let us return again to the subject of plant introduction and international plant exchange. Horticulture, we believe, is an important agent of civilization. The love of plants, and their intensive culture, attaches men and women to their homes, and makes of them more stable citizens. Accordingly, rich and poor of every clime should be able to easily obtain, under the proper quarantine regulations to restrict insect and disease pests, all the seeds and plants they need to beautify their homes, and to build those important plant industries which will contribute to their happiness and welfare. It was a great day when primitive man first scratched the soil, and gathering a few seeds or plants in the wild, planted and cultivated them near his home. Later he built a wall around his garden to protect the most precious of these plant treasures, and henceforth we had gardening within the enclosure, called horticulture. But it was an equally great day when man travelling to new climes tucked away on his person, or in his baggage, a few seeds or plants to take with him. Travellers and explorers, ambassadors and statesmen, Buddhist and Taoist priests and Church fathers, have all played an important role in plant immigration. In this modern day, when laws restricting such efforts of the individual are current, it behooves the higher organizations of government annd learning to pick up the torch and continue the trail.

In the world's development of cultivated plants China, with her "Farmers of Forty Centuries," the "Mother of Gardens," to quote the titles of two outstanding works on these subjects by the late F. H. King and E. H. Wilson respectively, is particularly deserving of attention. China, and neighboring countries of the Orient have given to the world many valuable plants, both cultivated and wild. Tonight you shall hear in slight detail of some Citrus fruits, the most striking botanical species of which first came from China, though these are now more highly cultured, selected, and hybridized in this and other parts of the world. I might dwell at length upon rice, soya bean, Lespedeza, sugar cane, the tea plant, the peach, disease resistant pears and chestnuts, the jujube, the persimmon, and more recently the wood oil tree, all of which have been a direct contribution from China to the world.

In China at this time we are particularly interested in the fact that species and varieties of plants sent from one country to another are often highly improved in the new country by selection, and by breeding with similar species from other parts of the world. These may later come back to the parent country in an improved state. Roses offer an excellent illustration of this, as your rose exhibit discloses. Of the hundreds of species of roses distributed throughout the northern hemisphere, there are about a dozen important British species, a dozen or more North American ones, and a similar number Chinese. Rose fanciers of Europe and America have crossed and recrossed these in hybridization, and from the results have selected and described an endless number of cultured forms which are being propagated true to type by cuttings and by grafts. *Rosa Indica* L., the fine red monthly rose of China, has been of unusual influence in this development, as have several other Chinese species. Today we are introducing into China, and are grafting into native stocks, these improved strains of roses from all parts of the world.

Sugar cane, though introduced into China proper, extended in its primitive range from India to Cochin-China. From southern Asia it spread into Africa, and then into the Americas. Improved strains of sugar cane are now being introduced into China from Cuba, Porto Rico, Hawaii, Java, and the Philippines.

Citrus is of chief interest here in Florida, as it is with us in southern China. Today many specific and varietal forms are recognized in botanical and horticultural literature. But ancient Chinese literature recorded but two main groups of Citrus fruits: the "Yau" or Pummelo, and the "Kwat" which was some kind of loose-skin orange, and from which the name Kumquat is derived. Later the sweet and sour orange began to appear in the literature, as also the lemon and citron. China is full of interesting Citrus forms, many of which are natural hybrids. But from the point of view of our present discussion I believe it will interest you to know that as a result

of our co-operative undertakings with the United States Department of Agriculture, we are now assembling for shipment to China, at Orlando, the better varieties of Tangelo. These are in reality man-made crosses between two modern forms of two ancient types of Citrus, represented by what we now know botanically as *Citrus grandis* Osbeck and *Citrus nobilis* Lour. I consider some of the varieties of these Tangelo, comparatively recent creations of the United States Department of Agriculture, some of the finest Citrus fruits in all the world. Possibly they are excelled by the better forms of Siamese pummelo, and which in reality are little more than glorified Tangelo,a Citrus fruit for a family breakfast table rather than for the individuals b'reakfast plate. Thus while we continue to bring from the Orient Citrus forms worthy of consideration for stock and disease resistance studies, as here and there a cultivated form worthy of our markets, we are likewise returning to China the more improved forms brought about through scientific hybridization.

Plant history in China is a fascinating study. The Chinese people have always maintained a liberal, broad-minded policy in plant exchange, not only carrying to other lands plants from their own, but making many useful foreign plants tributary to themselves, and amalgamating them with their system of agriculture. China, with her wide range of climate and soil, and with a people living in all parts of the world, presents the most striking evample of a nation in which most of the more useful plants known to civilization are cultivated. The introduction and absorption of these foreign plants into China has been a slow process, but considerable of the record has been preserved by historians.

The Hwangho basin in North China is generally considered the cradle of the Chinese nation. It is therefore not surprising that the earliest historical plant records in China refer to indigenous North China plants, for even at the time when Confucius compiled the classics in the fifth century, B. C., South China was a country of barbarians of which little was known. The Han dynasty Emperor, Wu Ti, 140-86 B. C., finally conquered this country, and thereafter records of South China plants, such as Lychee and Oranges, began to appear in Chinese literature. Some of these early northern Emperors were greatly concerned with the introduction of southern plants to their own areas. Many interesting stories are told of their failures, as in the case with the Lychee, when "several tens" of gardeners were killed because they could not grow these plants in the national arboretum at Cheung On, then the capital of the Empire.

The introduction of strictly foreign plants into China also began at about this time, for Chang Kien, one of the officers of Emperor Wu Ti, sent to the peoples dwelling on the northwestern frontiers of China is the first credited in Chinese history with the work of foreign plant introduction. It was at this time that the great Asiatic movement of cultivated plants in the hands of man was initiated, and it continued steadily until the fourteenth century and thereafter. From western Asia and Europe there came into China throughout this period a long line of flowers, vegetables, and fruits, including the Pistacia, Pomegranate, and cultivated Walnut; Cabbage and Cauliflower, garden Bean and Pea, Spinach, Sugar beet, Carrot, Lettuce, Cucumber, Watermelon, and numerous other vegetables. Poppy, yielding opium, the curse of China, is wild on the shores of the Mediterranean, and in culture it spread first into India and then into China.

In the sixteenth and seventeenth centuries, A. D., another stage of this great economic conquest began, when species from the Americas were first introduced into China and acclimatized. These include the Peanut, Tomato, Irish Potato, and Sweet potato. Corn or Maize when introduced, probably by the overland routes, spread both rapidly and widely throughout China. Dr. Walter T. Swingle has quite recently found some most interesting and important early records concerning corn in Chinese literature, as recorded in his reports of the Oriental Division of the Library of Congress. Of fruits, Papaya, Pineapple, Custard Apple, and more recently the Avocado, are all from Central or South America.

I promised to mention the genera in which South China's present subtropical fruit interests

largely lie, in order that you may judge in passing which may be of importance to you.

Within the family *Rutaceae* in addition to the members of the genus *Citrus*, we have a number of *Fortunella* species, both cultivated and wild. You seem to have received a good start in these Kumquats. We have several very interesting Citrus relatives under observation as possible stock plants, i. e., within the genera *Severinia* and *Atalantia*. To date neither of these have proven worthy except as most attractive ornamentals. Another Citrus relative of far greater importance, and which you should certainly begin to know more intimately, is the "Wongpei" or "Yellow-skin," belonging to the genus *Clausena*. Numerous species of this genus are scattered from Africa and Australia through Malaya to Southern Asia. The Chinese, without the background of that which today we call the science of fruit ecology, still seem to have developed on the northern range of culture the most outstanding edible fruit species of the genus, *Clausena lansium* (Lour.) Skeels. That this species can be grown in Florida has been demonstrated by a fruiting tree on the Federal Government Station at Orlando. Doubtless it has fruited also at other places.

*Burseraceae* yields two fruits in South China which apparently you have not yet introduced and do not know. I refer to two species of Canarium, that known as the White Chinese Olive, *Canarium album* (Lour.) Raench, and the Black Chinese Olive, *Canarium pimela* Koen. These are related to the famous Peelee nut of the Philippines, another member of the genus. The genus is rich in the tropics, but is known in China by only these two species which have also been developed by the Chinese on the northern range of culture, into these two important species of which there are many cultivated varieties. I am doubtful to what extent they could be made commercial here in the United States, but you should certainly have them as ornamentals, or as possible oil-bearing trees.

*Oxalidaceae* also yields two most interesting sub-tropical fruits which are widely grown in the Canton area. These are two species of *Averrhoa*, the one a sweet form, *Averrhoa carambola* L., of which there are a number of varieties, and *Averrhoa bilimbi* L., a sour form used as stock upon which to graft the former species. The Carambola is a summer fruit wonderfully refreshing. I am sure they can be grown on your hammock lands, and I understand they have already been introduced.

*Anacardiaceae* includes the Mango group, in which you here in Florida are rightly so much interested. But I fear you shall have to look farther south than Canton in Asia for the better varieites. However, Kwangtung and Kwangsi both have many interesting cold-resistant varieties which you should certainly have for breeding purposes. There is one most striking economic ornamental belonging to this family, *Dracontomelon dao* (Blanco) Merr. & Rolfe, a most attractive, immense, and long-lived tree which bears small, edible fruits highly prized in Chinese confectionery. The economic members of the family are inadequately studied in Southern Asia.

Within *Sapindaceae* is the Lychee, *Litchi chinensis* Sonn. which I have already mentioned. The more cold-resistant brother of the Lychee is the Lungan of the genus Euphoria, *E. longana* Lam. The genus Nephelium yields two highly prized but more tender species, *N. lappaceum* L., the Rambutan, and *N. mutabile* Blume, the Pulassan. The genus *Litchi* contains but two species, *Euphoria* eight or ten, and *Nephelium* several score. Work should be begun at once in the study and hybridization of the numerous members of the family surrounding the genus *Nephelium*.

The finest fruit in the world is said to be the Mangosteen belonging to the family *Guttiferae*. The genus *Garcinia*, to which the Mangosteen, *G. mangostana* L. belongs, is quite tropical in its range. But in Kwangtung we have at least one cold-resistant member, *Garcinia oblongifolia* Champ., and there are more in Indo-China. Here also is an interesting field for the breeder.

In passing I must also hastily mention Persimmons, Papaya, Loquats, Myrica species, the Eugenias, and the Artocarpus group. We have one native Artocarpus, found on the Island of Honan opposite Canton where our University is located, which has very attractive red, edible fruits, the size of a peach or larger. This has

recently been described and is now known to science as *Artocarpus lingnanensis* Merr.

It is obviously impossible for me to deal herein with the very interesting cultural methods practiced in the South China area. I can only say in passing that while we have much to learn from you in upland fruit culture, I believe you have much to learn from us in lowland culture. Practically all of the commercial Citrus grown in the Delta of Canton, in the lowlands of Indo China, and in the delta of the Menam river in Siam are planted on huge raised beds of bottom land soils, such as you have in this part of your state, with deep trenches of inflowing tidal waters between each bed. Trench and canal mud, rich in organic matter, is periodically smeared over these beds and the trees mounded. Intercropping seems partly associated with shading, and numerous trees of other species are usually found planted with Citrus, sometimes uniformly and sometimes at random in the groves. In the tropics Cocoanut palm, Betel-nut palm, and Banana are the chief species used. In the subtropics Lychee, Lungan, Carambola, and Canarium are the most common. In certain areas leguminous trees provide shade, increased nitrogen, and humus to the groves. In this country the Citrus industry is still very young, and no doubt you have not yet arrived at the best practices. I have an impression that on your uplands the average grower does not irrigate sufficiently, and on many of your lowlands a satisfactory drainage irrigation system has not been established. I do not believe Citrus growers either here or in China give their trees sufficient humus mulch; and I would like to see experimental work carried out to determine scientifically if species of Erythrina, Albizzia, and other leguminous trees can be worked into Citrus culture with profit.

We are now ready for the pictures. I trust that I have left you with a vivid impression of the aesthetic interest and persistent practices of the Chinese people in their horticultural pursuit, and in their constant efforts in the field of the introduction of new plants. I have mentioned some of the subtropical fruits and cultural methods of the Cantonese in southern China, and these you will do well to study further.

I am first showing you a few pictures of intensive Cantonese gardening. Beds of Allium, Chinese garlic, some with pots for bleaching and some without, prove a most profitable crop for market gardeners located near Canton city. Beds of Canton Ginger, the products of which find their way around the world and make the city famous, are commonly seen throughout the hot summer months. The lowland dyked areas, usually with Lychee trees planted along the dykes, are planted to rice, water chestnuts, or Sagittaria, and make the appearance of the whole delta area most picturesque.

Vegetable culture in the Canton delta has attained a high degree of development, but opportunities are still great for new introductions from the West. Within recent years we of Lingnan University have successfully introduced the better varieties of Lima beans, Sweet corn, Cauliflower, Tomatoes, and a number of other improved varieties of vegetables from the West. On the other hand we have sent you *Zizania,* Wild Rice, *Eleocharis,* Water chestnuts, Colocasia, Dasheens, and *Sagittaria sagittifolia* L., all of which should be well adapted to Florida conditions.

In passing it will interest you to note the difference in the development of Red peppers and Eggplant in the Orient and in the Occident. The original home of the Red pepper is Brazil. It was introduced into Europe in the sixteenth century, and spread to China. Upon arriving at Canton twenty-five years ago the long, slender types shown in the top of the picture, were those most commonly found. More recently we have introduced the bell shaped peppers from the West. It is interesting that a similar development, as to form, should have taken place with regard to the Egg plant, which is usually credited to the East Indies, and very early spread throughout Asia, Europe, and the Americas. But as to shape man's ideals in China seem to have been toward the elongated type, rather than the egg-shaped form which is more common in Western gardens. The latter is seldom seen in South China except by way of recent introductions.

You will be interested to know of our efforts with flowers. The Sweet peas introduced and growing on the campus of Lingnan University

are an inspiration to view. Many a small Chinese child's heart has been gladdened by this new highly colored flower from the West. Many a Chinese college youth, seeking to be modern, has tried to win fair lady by presenting a bunch of these rarer flowers. And many an aged Chinese lady, critical of most western innovations, will accept this little flower with pleasure. Naturally we take pride in our accomplishments, for we believe we are making a definite contribution to Sweet pea culture in the Orient. Success has been brought about through nearly two score years of effort, with increasing success each year. Hundreds of varieites have been tested in our gardens, and today we recommend only about a dozen varieties to be grown by the lay gardener in the Canton area. The sale of Sweet peas helps finance much other floricultural experimental work of which I could tell you if time was available.

Upon the five hundred acre campus of Lingnan University, once a graveyard, we have introduced many exotic trees and shrubs. Tonight I wish you to consider only the value of Eucalyptus of which we have tested in South China scores of species from Australia. I can recall, when I first landed in China, seeing only one or two trees of this genus growing on the Island of Hongkong. But what is the situation today? We are showing you here a closely planted grove of *Eucalyptus robusta* on our campus. The tree grows as well, or better, on the low-land, dyked areas than on the hills. It provides excellent materials for posts and firewood. It did not take the Chinese peasants living near the college long to discover that the fallen leaves from these trees are an important source of fuel supply. *Eucalyptus tereticornis* which we also introduced are of far greater beauty than the former species, and the timber can be used for building purposes and furniture. After our early success with these two, and a few additional species, we published in 1921 a little bulletin in Chinese, and thereafter public interest in the dissemination of Eucalyptus was greatly intensified. From our own parent trees we are now selling more than thirty pounds of seed each year. And the number of trees that can be grown from a pound of seed is enormous. We are also selling thousands of nursery seedlings. Recent government surveys estimate more than ten million trees in the province of Kwangtung. And the province to the west, Kwangsi, is pushing the introduction of Eucalyptus through their district forest nurseries. A few successes of this nature repay many fold the small expenditures necessary for work of this kind.

Of introduced fruits Lingnan's reputation is perhaps best known for papaya. The varieties we have introduced are currently known throughout the area as "Lingnan Muk Kwa" or "Lingnan Tree Melons." But in this plant introduction work one should differentiate clearly between the introduction of a species and that of a variety. In 1598 the Dutch traveler, Linschoten, wrote: "There is also a fruit that came out of the Spanish Indies, brought from beyond the Philippines or Luzons to Malacca, and from thence to India * * * and is very like a melon * * * and will not grow but always two together, that is male and female * * * and when they are divided and set apart from one another they do not fruit at all." Linschoten evidently did not know of the perfect flowered papaya, a variety of which we introduced to China from the Hawaiian Islands in 1912. In ripening quality and flavor the fruits from our trees proved far superior to native types, and we have never been able to produce sufficient fruits to meet the demands of the local markets. But the villagers surrounding the college are now growing these selections, and seed has been widely disseminated throughout Kwangtung and adjoining provinces.

Let us now consider again China's greatest fruit, the Lychee, thinking of its movements throughout the world from Florida's point of view. Of all the fruits in the world the Lychee possibly has one of the most narrow climatic ranges. When subjected to light freezes it is killed to the ground; and yet when not provided with sufficient cold weather for winter dormancy, though making fine vegetative growth the trees never fruit. Furthermore the seed of the Lychee is viable for only about a week, making transport in the seed stage impossible except when germination takes place enroute. These are great han-

dicaps to introduction of the Lychee into other areas.

Neither the federal government of the United States, nor the state governments of Florida or California where the Lychee might possibly be grown successfully have ever considered the Lychee industry seriously. Records in the United States Department of Agriculture from 1901 to date show a total of approximately seventy-five different introductions into this country from China, Java, India, and Hawaii. One of the earliest and most successful of these is S. P. I. No. 21204, secured from Fukien province through the courtesy of the Rev. William N. Brewster of Hinghua district. Plants from this introduction were propagated in the greenhouses in Washington and sent to co-operators in both California and Florida. One tree of this introduction fruited in California but was later lost through carelessness of the owner. Florida was more fortunate in that Reasoner Brothers of Oneco protected their tree, and have propagated and distributed trees from it to the present day. We have sent to Washington from the Canton area Mountain Lychee, so important for stock upon which to graft the more highly cultured forms, and such well known varieties as Glutinous Rice, Black Leaf, Cinnamon Flavor, Sweet Cliff, and others. Developments to date with the Lychee here in Florida indicate increasing success in favored areas. As the result of my recent visit to your state I am thoroughly convinced that it is only a question of time until you will see that the American people can have the delicious Lychee to supplement the summer fruits which they now enjoy. Meanwhile, recalling the words of Sung Chio, you can only enjoy this fruit with your ears, though the hearing of it no doubt makes you imagine you see it not only as here in the pictures, but in reality, and causes your mouths to water so profusely that you wet the skirts of your robes, embarrassing you so that you do not know what to do.

It is indeed a surprising fact that among all the varied fruits of the Western Hemisphere one does not find a single species belonging to the family *Sapindaceae*, although the recently introduced Akee fruit, of which there have been some discussions in these meetings, does belong to this family. For centuries *Sapindaceae* has provided Asia and the East Indies with four of their most distinctive fruits, namely the Lychee, the Lungan, the Pulassam, and the Rambutan. The two latter fruits are quite tropical and rarely appear in South China. You will note particularly the hairy nature of the Rambutan. In some varieties of the Lychee these hairs are reduced to blunt prickles, but in other varieties of the Lychee, and in the Lungan, the surface of the skin is quite smooth.

Most of the remaining pictures this evening deal with Citrus fruits and their relatives, including the acquisition, propagation, and dissemination of these for improved Citrus culture in all parts of the world. It is generally admitted that oranges, particularly the sweet, round ones, and the loose-skin Mandarin group, as also the small Kumquats, are all of distinctly Chinese or Indo-Chinese origin, spreading to other countries centuries ago. Even the Washington Navel Orange, introduced by the United States Department of Agriculture from Bahia, South America, in 1871, doubtless originated from a bud sport of some of our Chinese or Indo-Chinese oranges. As evidence I show you the picture of a basket of the famous Annam, Vinh oranges, budwood of which we secured near Vinh several years ago. One day while in that area we purchased all of the fruits of a particularly attractive fruiting tree, believing them to be typical of the Vinh orange, and no fruits of which on the markets had shown evidence of navel marks. However, after all the fruits had been picked from the tree we found among the lot just one fruit with a distinct navel mark at the pistil end. This was photographed in the field as you see it here. Another very beautiful and well flavored Citrus variety of Indo China is that known as "King of Annam," a very fine Mandarin. It is not the "King" orange as we know it, which also came from this area, its origin in Indo China being somewhat obscure. The whole Mandarin orange group has been generally known as Citrus nobilis Lour., the type being described by Lourerio in 1790 from Indo China. Of *Citrus grandis* Osbeck there are many delicious forms in Asia, it

generally being conceded that the best come from Siam. Several of these such as Kao Panne, Kao Phuang, and Thong Dee have been introduced and fruited here. At Orlando I have recently tasted some very acceptable fruits of these varieties; and when suitable cultural areas are found for them they should certainly make very desirable acquisitions to your marketable Citrus fruits. They are particularly good shippers and improve under proper storage facilities. Most of the delicious Tangeloes now appearing on your markets are crosses between the loose-skin oranges and the Grapefruit. Crosses using some of these delicious Pummelo as one of the parents may prove even more desirable fruits to be eaten out of hand or for the breakfast table. The great variation within the genus *Citrus*, and this ready natural crossing of the various species, makes the problem of the systematist difficult; but this change in form and response to culture lend zest to the work of the horticulturist.

When it comes to plant propagation the Chinese have worked out some most unique methods. The marcot box you see here, which is used for both Lychee and Citrus propagation, was devised by Mr. Eugene May of the United States Department of Agriculture, a great improvement over an ancient Chinese method of ringing the branches and then tying mud balls around the injured part. At Canton where beaten brass is so cheap we have made these boxes of thin brass sheeting, and have had excellent results with them. They are more durable than the pasteboard ones. The sun shinging upon the metal heats the sphagnum and sand medium and causes earlier rooting. The Chinese methods of inarching Sweet Oranges on Lemon or other stocks are also very unique and well executed. Top grafting old trees is often practiced in China, but budding rarely. You will be interested in this picture of *Citrus ichangensis* Swingle with the strikingly large petiole, inarched on Lemon. In addition to these pictures I am showing some Wongpei fruits, the Citrus relative which I mentioned earlier. You will also be interested in a glimpse of our Citrus parent plant grove at Lingnan University where we are collecting and studying varieties both native and introduced.

I have said very little with regard to Bamboo, in which we are very much interested, and believe you should likewise be. My colleague, Prof. F. A. McClure, is concentrating his efforts in this field. You will note here a corner of the Lingnan University Bamboo Garden, devoted to the production of shoots for sale. Species used for edible shoots are *Bambusa beecheyana, Bambusa oldhami,* and *Dendrocalamus latiflorus,* all sympodial species. Note how the farmers heap earth around the shoots, cut them from the parent plants, and carry them to market. Bamboo areas in China are most picturesque. The bamboo rhizomes you see here are ready for shipment to the United States. These are easy to ship in more or less dormant condition.

In closing I will return to the Lychee, and show you one or two more pictures, because I do not wish you to forget this very old fruit of China, now so promising as one of your newer ones. In China Lychee are not only grown in the hills but also along the dykes. You see here our parent plant Lychee orchard. And these are the glass-framed Wardian cases in which Lychee and other succulent, evergreen plant materials are shipped from one country to another. The airship "Clipper" now crossing the Pacific, and others like it to come soon, will greatly facilitate the work of plant exchange.

I am sure that we all agree this immensely fascinating field of international plant study and exchange is one of the most productive of world peace and prosperity. In the gardens of the world mankind is seen at his best. It behooves us in these days when time and space begin to disappear, to renew our interests, one people in the other; and to emphasize those constructive forces which we are finding it is so needful for us to foster, rather than the destructive ones which so stealthfully creep upon us. Here then is the field of conquest for the youth of our land who look out upon a distressed world. Plant interest, collecting, dissemination and exchange portend the dawn of the new day when the garden interests of mankind are no longer neglected.

# ACID AND BASE FORMING FERTILIZERS AND THEIR INFLUENCE ON THE REACTION OF SOME FLORIDA SOILS*

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A consideration of fertilizer materials furnishing the three major plant foods reveals the fact that sources of phosphoric acid and potash have remained almost constant while the sources of nitrogen have undergone decided changes. Superphosphate has been, and probably will continue to be, our main source of phosphoric acid in most fertilizer mixtures. In the year 1900, 79.8 per cent. of the total available phosphoric acid was attributed to superphosphate. At the present time superphosphate accounts for 86.6 per cent. of this plant food. This slight increase is due to a gradual decrease in the use of organic sources.

High grade potash salts such as the muriate and sulphate have furnshed between 71.3 per cent. in 1900, and 61.7 per cent. in 1931, of our available potash.

Nitrogen carriers have undergone noticeable changes. MEHRING and PETERSON (1) have made a study of fertilizer materials and fertilizer mixtures produced and marketed in the United States from 1880 to the present time. A portion of their findings in regard to nitrogen materials is plotted in Figure 1. From this chart one can see that organic ammoniates decreased from 88.3 per cent. of the total nitrogen consumed for fertilizer purposes in 1880 to 18.3 per cent. in 1932. The decrease is one of increasing magnitude. Nitrates during this same period while rising to various peaks and dropping from time to time, show a gradual trend upward until 1920, after which a fairly sharp decline in usage is shown. This irregularity in the use of nitrates has been largely due to economic causes, chiefly an increasing supply of cheap ammonium sulphate.

The use of ammonia and its salts, since 1920, has risen sharply until they account for practically 60 per cent of the total nitrogen in fertilizer mixtures. It is interesting to note that prior to 1920 when nitrates were on the increase the ammonium salts along with ammonia decreased. Another point brought out by this chart is the recent development of urea and cyanamid.

While organic ammoniates have decreased synthetic nitrogen bearing products have increased. Most of these latter materials carry considerably higher percentages of nitrogen than the old line materials. They are placed on the market in a relatively pure form, containing little or no alkaline forming elements. This has resulted in the production of acid forming fertilizers whose use on soils already acid may result in increasing the acidity of a soil to a point injurious to many crops.

Further work by MEHRING and PETERSON (2) on this subject consisted in tabulating the different forms of nitrogen used in mixed fertilizers and calculating the resulting acidity or basicity. A summary of this work is plotted in Figure 2. From 1880 to 1905 mixed fertilizers on an average appear to have been basic in their effects upon the soil. From 1905 to 1920 mixtures were only slightly acid. Since 1920 the acidity of fertilizers has increased rapidly.

PIERRE (3), (4) also has shown the influence of different fertilizer materials on soil reaction and has developed an analytical method for the determination of equivalent acidity or basicity of mixed fertilizers and fertilizer materials. Equivalent acidity may be defined as the ability of a fertilizer to produce acid or no acid and is meas-

*Prepared for presentation before the Florida State Horticultural Society by A. E. Hughes. Acknowledgment is made of suggestions of J. J. Skinner of the Bureau of Plant Industry, in charge of Soil Fertility Investigations in the Southeastern citrus and truck crop belt.

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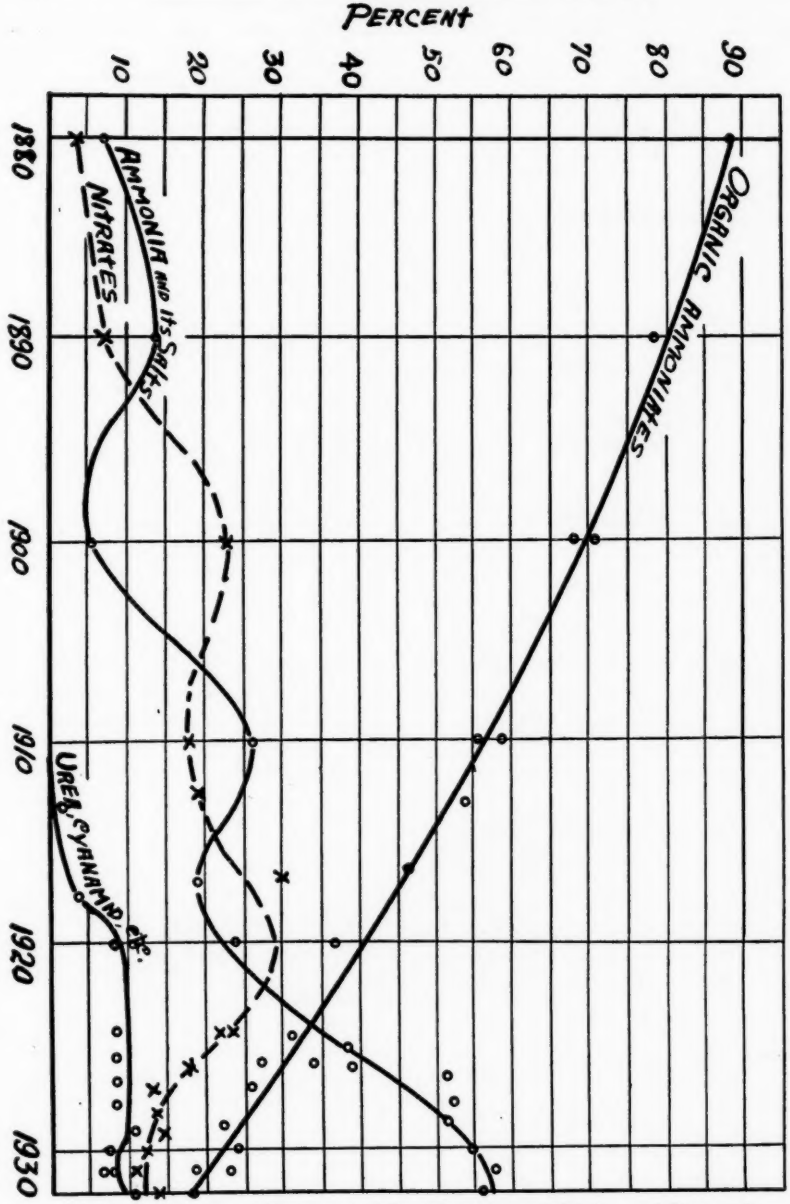


FIGURE 1. Source of Nitrogen in Mixed Fertilizers (Mehring and Peterson).

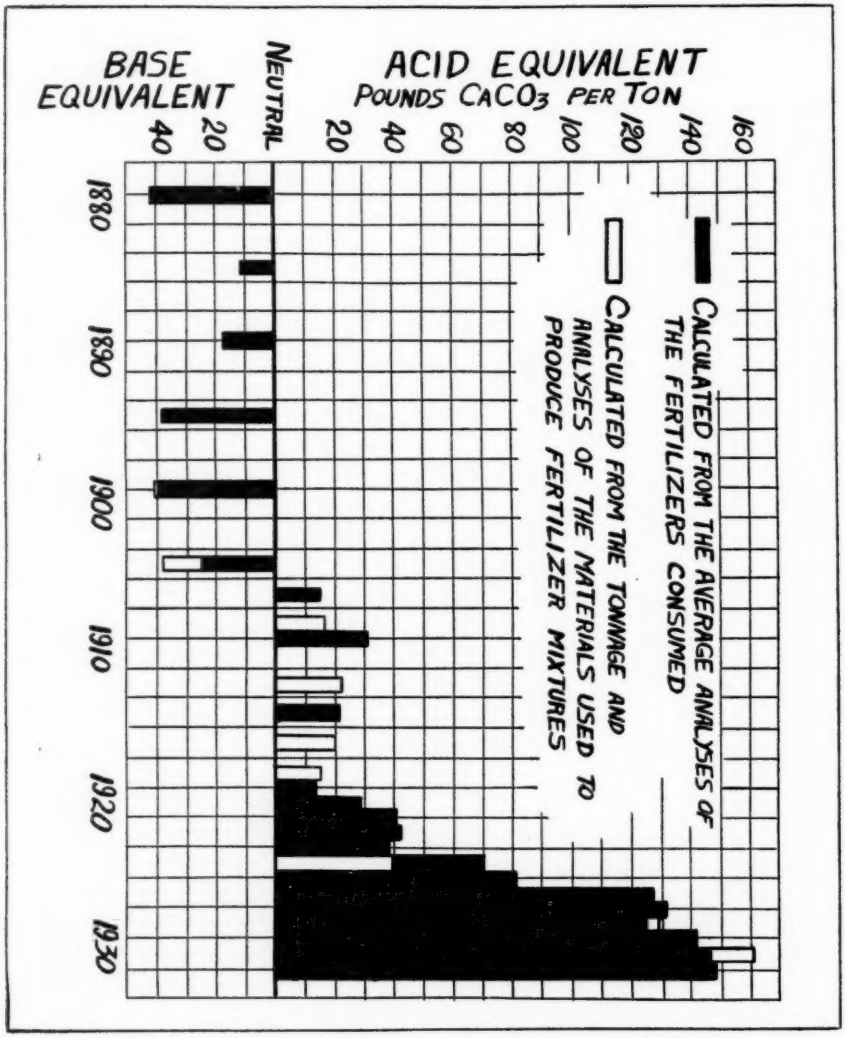


FIGURE 2. Average Equivalent Acidity or Basicity of Mixed Fertilizers. (Mehring and Peterson.)

ured in terms of calcium carbonate, usually expressed in pounds per ton or per unit of nitrogen.

The influence of fertilizers on soil reaction is determined by their acid-base balance. Acid-forming elements include sulphur, chlorine, phosphorus and nitrogen. Base-forming elements are calcium, magnesium, potassium and sodium. Certain combinations of these elements will give a neutral fertilizer as well as those possessing acid or basic properties. Some of the common fertilizer materials, containing those various acid and base forming elements, are given in Table 1, along with their acid and basic equivalents. From this table one can readily determine the amount of acid or basic properties of various materials in terms of calcium carbonate contained in a mixed fertilizer.

TABLE I

EQUIVALENT ACIDITY AND BASICITY PER 100 POUNDS OF PRODUCT IN TERMS OF CALCIUM CARBONATE OF SOME COMMONLY USED FERTILIZER MATERIALS. (PIERRE [3.4]).

| Materials | Percent. Nitrogen | Equivalent Basicity | Equivalent Acidity |
|---|---|---|---|
| Low Grade Tankage | 4.3 | 31.0 | |
| Nitrate of Soda | 16.0 | 28.8 | |
| Nitrate of Potash | 13.0 | 26.0 | |
| Calcium Nitrate | 15.0 | 20.3 | |
| Muriate of Potash | ..... | ..... | ..... |
| Superphosphate | ..... | ..... | ..... |
| Sulphate of Potash | ..... | ..... | ..... |
| Castor Pomace | 4.8 | | 4.3 |
| Fish Scrap | 9.2 | | 8.4 |
| Cottonseed Meal | 6.7 | | 9.4 |
| Dried Blood | 13.0 | | 22.8 |
| Ammo-Phos "A" | 11.0 | | 55.0 |
| Sulphate of Ammonia | 20.5 | | 110.0 |
| Urea | 46.6 | | 83.9 |

Further, by knowing the amount of each material present one can calculate whether the mixture is acid, basic or neutral. Fertilizer mixtures containing low grade tankage, nitrate of soda, nitrate of potash, or calcium nitrate, as nitrogen sources, will be basic in their effect upon the soil. Mixtures containing dried blood, Amophos, urea, or sulphate of ammonia, as sources of nitrogen, will result in an acid-forming fertilizer. The proportion of each used in a mixture will determine the degree of acidity or basicity.

Phosphate carriers vary considerably in their effects on soil acidity. A material such as superphosphate, in which the phosphate is present largely as mono-calcium phosphate, have little effect on soil reaction. Di- and tri-calcium phosphate exert a basic effect. Ammonium phosphate, however, increases soil acidity as do other common ammonium fertilizer salts. The nitrogen carriers are responsible for most of the fertilizer acidity effects, but not even all of these are acid forming. The nitrate fertilizers in which the nitrate is combined with calcium, sodium, or potassium, decrease soil acidity because the nitrate ion is absorbed by the plant largely apart from the bases leaving the latter to exert their full basic action. Cyanamid also exerts a basic effect.

Soil tests and field experiments have kept pace with the constant changes of fertilizers. NOLL, GARDNER and IRVIN (5) in a summary of results obtained with commercial fertilizers covering a period of forty-nine years at the Pennsylvania Experiment Station show that plots which received no lime additions for forty years showed a gradual decrease in production. At the end of forty years, lime was applied and there resulted an increase in crop yields. The greatest increase from liming was realized on plots where sulphate of ammonia had been applied. WHITE, (6) of the same station, as early as 1914, reports that nitrogen carriers such as sulphate of ammonia, dried blood and cottonseed meal, when used in fertilizer mixtures and applied to the soil, considerably increased the lime requirement of the soil to which applied. In each case ammonium sulphate caused the greatest increase.

SCHREINER and SKINNER (7) have pointed out that with the continued use of acid fertilizer smaller returns from cotton resulted, and further that when these fertilizers were blended so as to be neutral or base forming, increased yields were obtained. Interesting results have been obtained with concentrated acid fertilizers which have been properly blended with suitable basic materials for the purpose of avoiding high acid equivalents.

Further work reported by WILLIAMSON (6), TIDMORE and SIMMONS (9) show that incorporation of limestone in mixtures of fertilizers for the purpose of neutralizing acidity has resulted in an increased yield of fifty pounds of seed cotton per acre.

LINEBERRY (10), applying 750 pounds of 4-8-6 fertilizer to the acre on Norfolk fine sandy loam planted to strawberries, found that sulphate of ammonia, when used as a nitrogen source caused a considerable decrease in the pH value of the soil. Where nitrate of soda was used an increase in the pH value was found to ensue.

LEWIS and FOWLER (11), experimenting with pecans in Georgia on Greenville sandy loam, have obtained results which are in accord with other investigations.

In 1930, a series of experiments were started in Florida to study the effects of physiologically acid and basic fertilizers upon various soil types planted to citrus. These experiments include both single and double strength fertilizers. A study of conditions in the corresponding untreated soil was carried out. One of the features of this study has been a continuous determination from year to year of the pH value of the soil in each plot.

It is recognized that various soil types and different phases of the same type may react differently to similar fertilizer treatments and that a fluctuation in soil reaction from year to year may be influenced by a number of factors such as the underlying structure and the movement of soil moisture. It is of interest, however, to note the effects of acid forming and base forming fertilizers on the two soil types used in these studies.

The fertilizers used in these experiments have included both acid and basic mixtures in the single and double strength forms. In general the single strength acid-forming fertilizer has been a 4-8-8 mixture composed of sulphate of ammonia, tankage, fish scrap, superphosphate and sulphate of potash, the mixture having an acid equivalent of about 305 pounds of calcium carbonate per ton. The double strength acid forming fertilizer is an 8-16-16 mixture composed chiefly of urea, Ammo-phos and sulphate of potash, having an acid equivalent of about 532 pounds of calcium carbonate per ton.

The single strength base forming fertilizer is a 4-8-8 mixture composed of nitrate of soda, dried blood, steamed bone, superphosphate and sulphate of potash, having a basic equivalent of 401 pounds of calcium carbonate per ton. The double strength base forming fertilizer is a mixture made up of Calurea, triple superphosphate, sulphate of potash and ground calcium limestone. A more detailed description of these mixtures is given in another paper at this meeting by Mr. G. M. Bahrt.

The single strength fertilizers have been applied, in general, at the rate of ten pounds per tree, three times each year, to Valencia oranges grown on various soil types. The double strength mixtures have been applied at the rate of five pounds per tree, so that in each treatment all trees received the same amount of plant food. Composite soil samples of three successive, six

TABLE II

CHANGES IN pH OF NORFOLK FINE SAND (ROLLING PHASE) PLANTED TO CITRUS, INDUCED BY ACID AND BASIC FERTILIZERS

| YEAR | Single Strength | | | Double Strength | | |
|---|---|---|---|---|---|---|
| | 0-6″ | 6-12″ | 12-18″ | 0-6″ | 6-12″ | 12-18″ |
| | | | Acid Forming | | | |
| 1931 | 5.54 | 5.57 | 5.60 | 5.24 | 5.50 | 5.50 |
| 1932 | 5.14 | 5.16 | 4.80 | 5.36 | 5.16 | 5.22 |
| 1933 | 5.19 | 4.95 | 4.93 | 5.36 | 4.99 | 5.19 |
| 1934 | 4.48 | 4.95 | 5.35 | 4.97 | 5.06 | 4.90 |
| | | | Base Forming | | | |
| 1931 | 5.55 | 5.59 | 5.69 | 5.59 | 5.59 | 5.76 |
| 1932 | 5.73 | 5.41 | 5.77 | 5.07 | 5.28 | 5.25 |
| 1933 | 5.37 | 5.34 | 5.34 | 5.51 | 5.19 | 5.19 |
| 1934 | 5.42 | 5.28 | 5.48 | 5.55 | 5.12 | 5.00 |

inch depths were taken from each plot regularly every year over a period of four years and the soil reaction determined by means of the hydrogen electrode method.

Table 2 shows the results obtained on a Norfork fine sandy soil of the rolling phase, typical of soils of the South-Central Citrus Belt of Florida. In the plots receiving the acid forming fertilizer there is generally a decrease in the pH of the soil. While the decrease is not pronounced in some cases yet the trend is toward a lower pH value.

This soil became more acid in the four years it has been under study even when a basic fertilizer was used. However, in the surface six inches of soil, where fertilizers probably have most influence, increased acidity was less with basic fertilizers.

In figures 3 and 4 are given the results obtained with an acid forming and basic forming fertilizer on Norfolk fine sand of the low hammock phase, a soil type found extensively on the East Coast of Florida, used for the growing of citrus fruits. The soil of this experiment is naturally acid, although it may be underlain at considerable depth by calcareous rock. Where acid forming fertilizer was used the results show a lower pH of the soil which became more pronounced after four years. With basic forming fertilizers there was an increase in the pH value of each six inch layer of soil the first year, a lowering of the pH value the third year, a decided increase the fourth year, which resulted in a considerably higher pH value of the soil than in the beginning.

## SUMMARY

Since 1880 mixed fertilizers and fertilizer materials have changed from substances possessing basic properties to those possessing acid properties, especially the nitrogen carriers, many of which contain high percentages of plant food.

In recent years investigators have found that a large proportion of the fertilizer used to promote crop production has tended to make the soil more acid. Frequently this increase of soil acidity has resulted in reduced crop yields.

This condition has stimulated various investigations out of which has developed a method for determining the acid and basic equivalents of fertilizer materials and mixed fertilizers and the production of neutral fertilizers by blending the proper materials with dolomite and calcium carbonate, thereby preventing undue soil acidity and losses of basic material from the soil, and promoting more economical crop production.

Studies on two Florida acid citrus soils with acid and basic fertilizers show that the respective increase or decrease in pH value is not of the same magnitude on the soil types. There is, however, a general trend toward lower pH values when an acid forming fertilizer is applied over a considerable period of time. Likewise there is an increase in the pH value when base forming fertilizers are applied or a tendency to prevent the lowering of the pH of a naturally acid soil.

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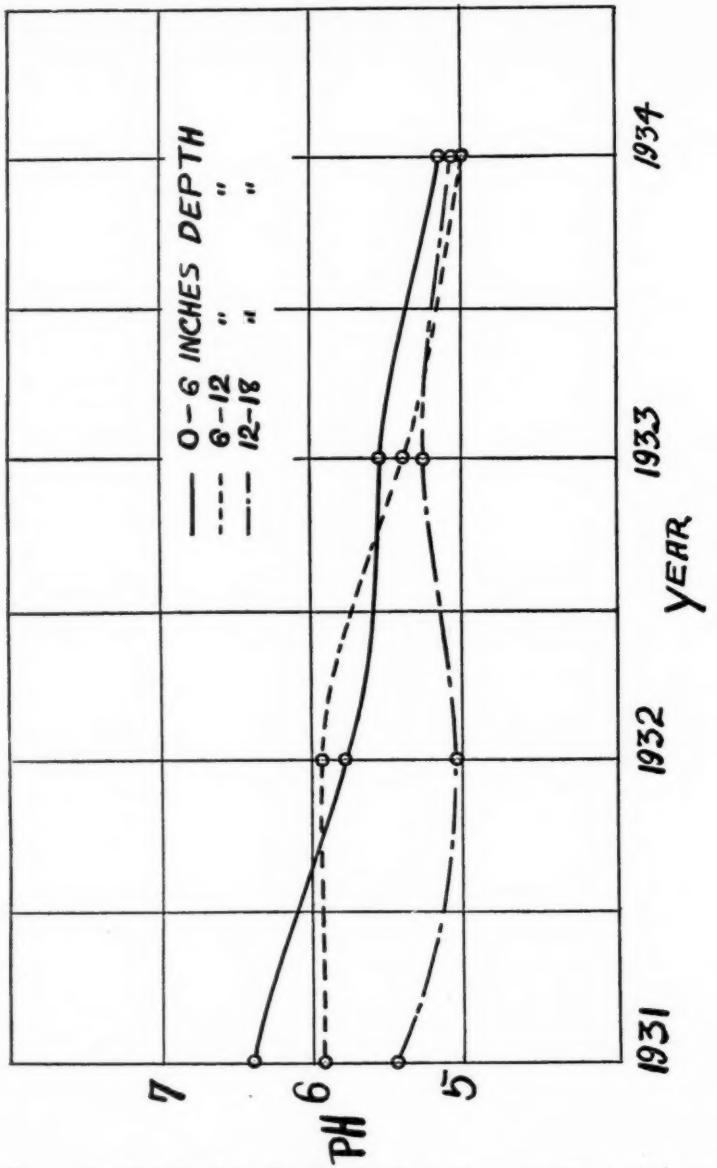


FIGURE 3. Changes in pH Induced in Norfolk Fine Sand (Hammock Phase) Planted to Citrus, by Continued Use of Acid Forming Fertilizer.

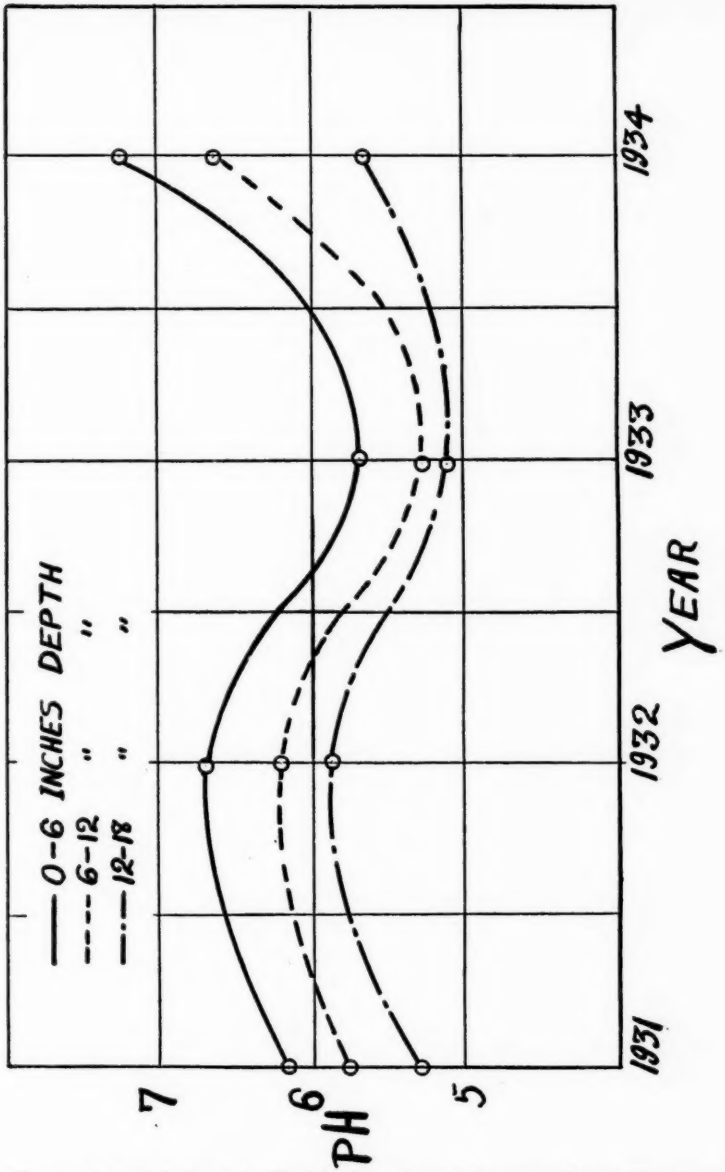


FIGURE 4. Changes in pH Induced in Norfolk Fine Sand (Hammock Phase) Planted to Citrus, by Continued Use of Base Forming Fertilizer.

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## THE UNDERPRIVILEGED CITRUS GROVE

**T. A. Brown, Nocatee**

This topic, as is said of charity, "covers a multitude of sins." Before we can start to discuss it properly, we must first decide just where to draw the line between the underprivileged grove and the grove that just never was worth the privileges it has had, and to illustrate my point I want to quote the late Dr. David Starr Jordan, founder and builder of Leland Stanford University. He became famous as an educator largely because of his belief in giving every worthwhile boy a chance for an education if possible in any way. One of the blunt truths credited to Dr. Jordan which helped to make him famous, was, "It is a crime to turn a million dollar boy off with only a fifty cent education; but it is also just as great a crime to waste a million dollar education trying to hang it onto a fifty cent boy."

So it is with the orange grove to a great extent, and is getting to be more so every year. Many groves that used to pay some profit nearly every year during the happy days of $1.00 per box on the tree as a regular thing, are now pitiful wrecks that ought to be dug up and burned, because having once fallen by the wayside they have gone just a little deeper in debt each year until there seems to be no hope of their ever meeting the strenuous competition, at present or in the near future. It would seem that this is the year to abandon such property, turn the cows into it and spend any available money to rebuild the groves that will be able to make the grade and return a profit.

The grove that is known to have consistently made some profit and that will beyond doubt make good right on, is not to be discussed here because it is assured of the necessary care to enable it to go on and produce the goods. But the grove in between it and the kind first mentioned, the grove that seems to be well located and good varieties, but just hasn't had quite the proper care to enable it to withstand the natural climatic hazards and still keep on the profit side of the line, is the grove that properly comes in for consideration at this time.

We have just lots of such groves all up and down the state. Groves that look good much of the time but which just seem to be slipping back below the profit line too regularly to make their owners very happy about the situation. And we sometimes have to stop and wonder if it really is the fault of the grove, or is it the management that is at fault? So before we decide to condemn the grove and abandon it, or before we decide to go out and borrow any money to spend on its rejuvenation we should have a very careful stock-taking, and here are a few of the questions, the answers to which would be most helpful in forming our conclusions: viz:

How many years since the grove came into bearing?

Was it ever considered to be a really profitable grove?

If so, what part of the profits were reserved as a sinking fund to tide the grove over any such contingency as a freeze, hurricane or other calamity?

Is there adequate drainage and water supply?

What is the general condition of the root

system of the trees, and if not good can the condition be remedied effectively and economically?

And finally, if the grove has been mortgaged at any time, was the money so obtained used for the proper care of the grove, or for some other purpose not related?

Some great man has wisely said that there is just 2% difference between the man who is successful and the one who is not successful. That takes for granted that 100% is par. If the same rule applies to grove property, it might be a pretty good idea to do some bookkeeping on the operation (which most small growers don't do), but which every grove management should include. The different grove operations should be grouped according to relative results desired, and a study made of whether each operation involved proved to be really profitable. It might be found that some of the things that cost considerable money could be done without very nicely for a season or two, or even for several years at a time.

I can well remember being asked to visit more than a few groves to advise the owner as to why his trees were not doing as well as they used to do, and on close questioning about certain practices, brought out the fact that the reason the grower followed these certain practices that I questioned, was that he always had done just that certain thing for so many years past.

Well do I remember having been told many times that the reason the grower continued year round clean cultivation was that he didn't want the grass to get any of his fertilizer, nor would he have a cover crop for the same reason, that it would be bound to get too much of the fertilizer intended for the trees. And let me tell you folks, these growers I am thinking about were not beginners at that time but many of them had been right there on the same groves for twenty years or more and they spent time and money year after year harrowing and hoeing bearing groves all summer just to keep the grass from getting some of their fertilizer, and because they always had done that way, and yet they wanted to know why their trees were not doing as well as they used to. The leaves were so small and there were so many dead twigs, and the color of the foliage was so badly bronzed or yellowed or frenched that the grower was getting alarmed and discouraged, and it seemed that no amount of extra cultivation or usual fertilizer formulas made any improvement.

I have frequently seen good growers, of years of experience get so in the habit of doing things in a certain way that they would continue the use of a certain fertilizer formula that had once worked with excellent results, until the supply of plant food in the soil got so badly out of balance that the poor trees could only stand still and cry out for a change of food. I have also seen many groves where plenty of good fertilizer was applied in the middles, and then the roots kept broken off with deep cultivation until they could not reach the food, with the result that the trees got harder, the foliage smaller and thinner and the crops less every vear until the owner either realized his mistake and changed his tactics, or gave up the grove as played out, and sold it for what he could get or let the mortgage take it.

I have also known good groves to go to ruin because the owner or caretaker during a few seasons when the rainfall had been moderate, had failed to notice that the drainage ditches were filling up with soil, and even if they did notice that condition just neglect to clean and deepen them properly until some fine day there came so much rain that before he knew it the whole area supposed to be drained, had been so water logged that the roots had soured and the tops of the trees began to die back, indicating that the lower roots were no longer functioning.

I can remember right here in this very section not so many miles from where we are right now, when a new disease was discovered in the groves and a great hue and cry went up for specialists to make haste and examine the affected groves to determine what should be done. Trees were dying from the tops down at a rapid rate. not only isolated trees but whole groves and grove after grove in some sections. Outside men came in to see, and after looking and asking questions and boring holes and much shaking of heads and muttering, some one got a shovel and followed the moisture level from the water furrow between rows, right straight to the taproot of an affected tree making a cross section of the mound on which

the tree row was set. The result was that this cross section showed that before the big canal was opened nearby, there had been a very wet season, and all roots more than 2 inches below the root crown on top of the ridge had been killed by excess water damage. Following the opening of the drainage canals the water table went down and the tree mounds or ridges were dry as powder after a few weeks of dry weather and the trees were dying for want of enough water.

When the flowing wells were opened up and reasonable irrigation applied, the dread new disease disappeared and has not been reported from that section since, that I have heard of. And yet, the owners of thse groves, who had planted them and lived with them and waded knee deep through them during flood time, failed to notice that the upper roots were in dry sand, while the lower roots were dead and could not bring up the moisture that was right there so close and yet so far out of reach.

After a couple of years of careful irrigation and drainage, those same groves revived and put down roots to the lower levels and re-established themselves very nicely and profitably. Just on the strength of that one little 2% of attention.

Would you have called that an "underprivileged condition"? I believe I would. Would you call the grove which is turning yellow and frenched, and where the crop of dead twigs exceeds the crop of new growth each year, owing to too much year round clean cultivation, an "underprivileged grove"? I believe I would. And would you call the grove which has had 2-8-10 and 3-10-12 fertilizer a plenty until it has stopped growing and hardened up to the point of remaining practically dormant the year round owing largely to an excess of potash, an "underprivileged grove"? Yes, I believe I would.

But after all, while there are a great many groves that fall in the underprivileged class and still get too much of something that costs money or labor, there are probably a much greater number that are underprivileged because they do not get their just share of the earnings that they have made in the past.

If I had to take over 100 well located but underprivileged groves in any part of Florida, I should expect more than half of them to be suffering for something needed rather than too much of anything that had been provided.

In most cases I should expect to find them suffering to some extent for organic humus in the soil and commercial fertilizers to aid in proper feeding. I should expect to find some of them suffering, or at least failing to produce a profit owing to the lack of ample water at some considerable period of the active year. I should expect to find some of them suffering from too much and too deep cultivation and maybe some of them suffering for the want of some cultivation, and occasionally I would expect to find some of them suffering for better drainage.

Granting then, that some of you folks are now, or will soon be in possession of the kind of grove we have been trying to generally describe, "The Underprivileged Grove," you may want to know after all my criticism, just what I would suggest that you do with or for such a grove. All right, granting that the operation is amply financed, and has been right along, check up and see what it is you are doing that you should omit, and then check over agaiin to see if you are doing too much of one thing and not enough of another, thereby throwing your operation out of balance. If you want to do any experimenting with new or revised practices with which you are not familiar, set aside a small block and experiment thoroughly but on a small scale until you have proof that you have accomplished something definitely recognizable.

If your finances are limited and you have to make every dollar do double duty so to speak, and your grove has just suffered from the lack of attention and food, give it what you can, first food, then water if you can get it, if not, a reasonable amount of cultivation. In feeding a tree that has been underfed bear in mind that the first thing that a hungry tree wants is nitrogen in some readily available form. If you can buy the proper balanced fertilizer mixture, fine, and maybe you had better also give it a little nitrate of soda or other quickly available source of nitrogen, and if you can't buy mixed goods, give it the quick nitrogen anyhow if possible, and don't let anyone scare you about a single application or

even a couple of applications of just straight synthetic fertilizer, whatever you can get in a reasonable amount. But while you are making out the best you can this way, bear in mind that a tree cannot always live on just synthetic plant food any more than a man can live on straight bread or a horse can live on straight corn. All will get along all right for awhile but it requires something eventually to back up this incomplete ration, and one of the best means that I know of to balance up this incomplete grove ration is to provide a good cover crop to rot back into the soil. There may be talking points against a cover crop, but if you can understand tree talk you will soon be convinced that a good cover crop, especially crotalaria, is worth a whole lot of effort and some expense. In figuring out your efforts to allow your grove more privileges, don't go and cultivate it too much. Why it makes me sick at heart to see the way some of my neighbors on the west coast plow their poor groves to death. If their groves had all kinds of fertilizer in the topsoil they wouldn't let it lie still long enough for the roots to pick it up, and it sometimes looks to me that if these growers must spend so much time trying to do something for the trees, that they would better go fishing and put the fish they catch on the grove for fertilizer. Even if they didn't catch but one fish a day their groves would be much better off in many cases.

If you must dig at the soil, after you have given your grove a reasonable amount of cultivation, go and open up any drainage ditches that the grove may need and then thereafter keep them open so as to maintain a regular root level in the soil.

If your trees are very hungry you needn't generally worry much about the scale or whitefly damaging them unless they are alongside of a dusty road when scale might need some attention at times. Examine the trees, and fruit if any, occasionally for rustmites and don't let them damage your fruit or foliage if you can avoid it. Only one good spraying or dusting, if done at the right time may reduce the mite damage well worth the effort and expense, and most years two or three properly timed sprayings or dustings will handle the mite situation very satisfactorily.

Ordinary years, some dead wood will accumulate in the best groves, and this should be pruned out whenever enough appears to make the operation economical. The "underprivileged grove" is likely to have a more or less heavy percentage of dead wood. I would get this out as soon as possible, but if it is a choice of pruning or fertilizer, I would take the fertilizer every time.

In conclusion, let me say that the element generally most needed by the underprivileged grove, is better management, and the way to become a better manager is to watch carefully what not just one neighbor does, but what they all do and then watch your own doings rather critically.

## THE IMPORTANCE OF QUALITY OF CITRUS FRUITS, WITH PARTICULAR REFERENCE TO GRAPEFRUIT

**Frank L. Holland, Winter Haven**

At the outset let me say that this discussion will not be along usual lines in that the word quality is used with reference to the interior of the fruit and not the exterior. Quality in the minds of most people pertains to external appearance only. This is of great importance and well worth all efforts put forth on this phase of quality in citrus fruits in the past, and will warrant probably increased efforts in the future.

Neither will the discussion cover shipping green or immature fruit. There simply isn't any reason for shipping *inedible* fruit. Such fruit has no quality and therefore is left out intentionally! My desire is that you think only of ripe fruit in connection with my few remarks.

I wish to discuss "Quality," as pertaining to the contents of the fruit, its meat and juice, its flavor, and its real eating and health qualities.

When notified by your Secretary as to my subject, I made it my business to talk with as many growers, buyers and authorities on citrus fruits as was possible. I gained the very definite impression that the eating quality of much fruit has been gradually but definitely getting poorer during the past several years. No less an authority than Mr. H. Harold Hume told me yesterday: "There has been very little good fruit this season, and I am not referring to cold and drought effects."

It may be well at this point to check up on various meanings of the word "quality." From some authorities we find that it is used in three different ways: In a primary way, referring to the shape of an object; in a secondary way, referring to the color of an object; and tertiary, dealing with "ultimate values," degree of goodness of an object, its relative excellence by comparison, or its "peculiar excellence" if not by comparison.

It may be truthfully said that the American public learned to buy, eat and like grapefruit on the basis of eating quality and dietary value of our grapefruit as produced several years ago—you might say due to its "peculiar excellence." Does anyone know of any grapefruit that will compare in eating quality with grapefruit from old seedling trees, or old budded trees of seedy varieties grown on fertile soils. If all our grapefruit was as good as that, and in addition had a bright pleasing appearance, would it not mean much to us. Is it not also true that the fruit produced in former years "held up" during the period of time between picking and final consumption better than a great deal of the fruit produced today.

For specific comparison, from the quality viewpoint, of some standard varieties of citrus fruits as produced today and in past years, let us consider briefly some of the characteristics given by authorities as being descriptive of typical fruits of certain varieties.

For instance, Dancy tangerines: flesh, dark orange; juice abundant, colored; pulp melting, acidity and sweetness well blended; flavor rich and sprightly; quality excellent.

Pineapple orange. Juice abundant, pulp melting; acidity and sweetness well blended; flavor rich, vinous, sprightly.

Valencia orange. Juice abundant; acidity and sweetness well combined; pulp melting; flavor rich, sprightly and vinous; quality excellent.

Ask yourself honestly how much of your fruit meets such specifications. Will a basket of your fruit fill your dining room with tre incomparable aroma given off by real quality fruit having honest to goodness flavor?

Now as to characteristics of grapefruit. Duncan—bitterness well marked; acidity and sweetness good; a variety of superior quality.

Excelsior—bitter principle well marked; acidity normal; quality good.

Walters—bitter principle strongly marked; acidity and sweetness good; quality very good.

Marsh—bitter principle not strongly marked; acidity and sweetness medium.

It will be noted throughout that the actual quality factors of the seedy varieties are given a higher rating than those of seedless.

This whole question of "Quality" in seedy grapefruit appears to be one of the most important, if not the most important, problem in citrus circles today in Florida. We have a tremendous acreage of seedy grapefruit that has been unprofitable generally in recent years. If anything can be done to improve the seedy grapefruit situation it should have a very marked beneficial effect on the citrus industry of the State as a whole.

Our grapefruit does not benefit by advertising programs of other states like our oranges do. In fact it may be said probably that the widespread and efficient orange advertising programs of other states have made the country orange minded, as far as citrus fruits are concerned. It is also true that oranges do not have the same specific competition that grapefruit have due to certain fundamental differences in the two kinds of fruit, manner of use, etc. Grapefruit must compete with all other breakfast fruits and dishes, practically all other salads and now with ginger ale. It doesn't get any help from California and gets nothing but hard competition from Texas, both as to advertising and sales. It msut have

merit of its own to support our advertising and sales efforts, if we are to get back on a profitable basis in our common grapefruit industry.

Our out-of-state grapefruit competition has been principally with seedless varieties. Some feel that the bad situation in the Florida grapefruit deal is a result of other things besides poorer quality including: developing an inferiority complex because of the seed in our fruit. Many feel that this has developed due to the continuous advertising of "seedless" fruit by our principal competitors. This must be merely a bug-a-boo as far as grapefruit are concerned, because we all know that when the juice is served the seeds are removed; when the fruit is served in half it is cored regardless of whether it was a seedy or seedless variety; and when sold in cans the consumer sees no seed, but practically all canned grapefruit is some "seedy" variety. In other words the final consumer; the person who actually eats the fruit or drinks the juice, knows little or nothing of the seeds that were once present in the fruit, excepting of course in home consumption.

If the profitless situation of our seedy grapefruit industry has developed because of an inferiority complex due to seeds in our fruit, or because of unconscious feeling that the seedless fruit would run it off the market, it would seem that there are some things that could and should be done to correct it.

*First*: Growers must fertilize and otherwise care for their groves in such a manner as to produce grapefruit of real flavor and quality. Produce the kind of grapefruit that made the public learn to like and use it years ago.

*Second*: Advertising and sales agencies should conduct their campaigns so as to capitalize on the *superior qualities* of seedy or common grapefruit. Let the consuming public know that such fruit has better flavor, richer juice, greater medicinal and dietary value. Above all, tell the public that seeds in grapefruit are indicative of such valuable characteristics in the fruit itself.

In connection with the first point, suggested above, there is need for some research on the part of State and Federal agencies dealing with these points that go to make up eating quality, and what practices are necessary if the very highest eating quality grapefruit is to be produced by growers.

In the meantime, however, we do know how to grow better fruit than many of us have been doing in recent years, and we can get back to our own original standard of quality fruit at once, and improve on that as additional facts are developed.

In connection with the second point suggested, it would seem desirable for some research to be done on dietary and medical values of our seedy grapefruit, compared with seedless varieties, and compared also with competitive products.

As said above, however, practically everyone will agree that a real good seedy grapefruit is far superior in eating and juice quality to seedless grapefruit. It is also generally considered that the health values of seedy grapefruit are greater than those of seedless fruit. We see many competitive articles, including our oranges, advertised largely on the basis of their vitamin and mineral content. Our seedy grapefruit have outstanding values along these lines so why not capitalize on them, and at the same time be selling the public a more desirable, more valuable and more tasty fruit to eat.

The whole country is diet conscious, and our common seedy grapefruit undoubtedly have special value along this line. Yet we say little or nothing about this, and actually blush and apologize because our fruit has seeds, all of which pleases our competitors. Also, in so doing, we eliminate our chances of making a profit, and stint our groves so the original quality of our fruit is lowered beyond a profitable point.

Perhaps it will be possible for the discussed Citrus Commission to sponsor some research work on grapefruit along this general line of diet value. Although the proposed bills, I believe, provide specifically for advertising funds, it would seem reasonable that the Commission could legally and wisely spend some of this money along lines of nutritional research in order that they may really have more valuable data to use in their advertising programs.

Such a program of advertising and sales need not react harmfully to the sales of our seedless grapefruit in Florida, because of the difference in the range of the marketing seasons which the two

types generally have. The facts would seem to be that such a program would benefit growers of seedless grapefruit, in that the market for seedy grapefruit, being raised over its present level, should have a tendency to relatively increase the price, or at least strengthen the market for seedless grapefruit when its season came in. Also could we not stress the "Seedless" nature of such varieties *during their marketing period,* thereby taking a leaf out of the book of experience of our competitors.

In making the statement earlier that eating quality of much grapefruit has become poorer in recent years, questions naturally arise in our mind as to reasons for such condition. There probably are many reasons but among others occur the following: First, earlier plantings were made on more fertile soils while later plantings have been made on less fertile and thin soils. The consequent effect on eating quality of fruit must be recognized. Second, it is probable that many of us newer and younger growers fail to really understand and appreciate true eating quality of citrus fruits as was true of such men as Messrs. W. S. Hart, E. L. Wartman, H. B. Stevens and other gentlemen who have truly understood citrus fruits from a quality point of view. Third, variations in rainfall and climatic conditions from season to season. Fourth, changes in grove practices in recent years are quite generally considered as having tremendous effect on the eating quality of fruit, particularly on thin sandy soils.

Reference is made to changes in fertilization, cultural and other phases of production.

A word in connection with the last named reason may be in order. We growers have deliberately planted groves on some thin, sandy lands because of cold protection and for other reasons. When we did this we knew that the soil was relatively infertile and that our production programs, particularly with regard to fertilizers, would be necessarily somewhat more expensive than they would be on heavier lands. Are we pulling down essential quality in a mad scramble of economy along production lines? Are we carelessly or deliberately destroying the foundation on which a successful industry must depend? Can we expect to regain and maintain a profitable grapefruit business if our fruit does not have eating quality, regardless of how pretty it may be to look at?

The whole matter at the present rather resembles the old question of "Do we live to eat or eat to live." Shall we find out and do the things necessary to produce and sell grapefruit of real eating and medicinal quality thereby making our business profitable, or shall we mosey along waiting and hoping for a high market during a big crop year to set us up financially?

Probably we will all admit that scientific studies of the values of citrus fruits, particularly with regard to quality factors, are of great importance to growers. Both State and Federal agencies have been doing a great deal of constructive work, but with insufficient funds and personnel, it is impossible for them to do everything. It would seem to be to the advantage of us all to get behind a movement now under way to get the Legislature to appropriate more money for citrus research work, so that this matter of eating quality, in addition to othe important items, may be investigated. Judging from market prices for much of our grapefruit this year, we better rush this appropriation for research work along, or we will need an undertaker rather than a research worker.

In conclusion, I wish to restate that this country learned to buy, eat and like grapefruit on the basis of the eating quality and dietary value of Florida grapefruit as produced years ago, you might say due to its "peculiar excellence." At the present time it appears necessary that we must get back to producing such grapefruit again, find out and advertise what makes up its peculiar quality, its medicinal and dietary values; advertise our fruit as what it really is. The starting point of this must of necessity rest with the growers who are the producers of the fruit, backed up by advertising and sales agencies.

Suggested research work should be of help in future years, but it is felt that we already have ample practical knowledge and other information, pertaining both to production and consumption of seedy grapefruit, on which growers, advertising and sales agencies can base an active, successful

campaign for restoring our common grapefruit industry to a basis of *quality* and *profit.*

There's no denying that our common grapefruit industry is sick. The tremendous investment at stake would seem to warrant taking immediate and, if necessary, extreme measures for its recovery.

SUMMARY

This is a brief, general discussion of the importance of eating quality in citrus fruits, with particular reference to grapefruit.

The situation, as it exists in part, with respect to seedy or common grapefruit is emphasized. Some thoughts are expressed concerning some of the factors contributing to this situation from viewpoint of eating quality; and from viewpoint of advertising, sales and consumption of such fruit.

Some suggestions are advanced as to needs for, and ways and means of (1) improving the eating quality of much grapefruit as now produced, (2) capitalizing on the natural superior eating quality and other characteristics of seedy or common grapefruit. It is suggested that this would be of benefit to consumers and the industry as a whole, as well as to individual growers.

Footnote: I wish to acknowledge the constructive suggestions of Mr. C. W. Lyons of Tampa in connection with parts of this paper.

# RECENT DEVELOPMENT IN CITRUS SOIL FERTILITY INVESTIGATIONS*

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**U. S. Department of Agriculture**

As a result of experiments with citrus on several soil types in Florida, it has been reported (1) that fruit obtained from trees to which complete fertilizer and manganese sulphate were applied, required more pressure to crush than fruit from trees receiving only commercial fertilizer. It was later reported (2) that tangerines and oranges obtained from trees to which manganese sulphate was applied in addition to the complete fertilizer had a more intense color in rind than fruit from the plots to which fertilizer only was applied.

In 1930 experiments were started to investigate the action of single and double strength acid and basic forming fertilizer on acid and basic soils and the influence of minor essential plant food elements used with each fertilizer. A single strength fertilizer was used, having a formula such as 4-8-8 or 3-8-5, and a double strength fertilizer, having a formula such as 8-16-16 or 6-16-10. The acid soils selected were the Norfolk fine sand, rolling phase, at Winter Haven, typical of citrus soils of the ridge section of Florida, and the Norfolk fine sand; Low Hammock phase, at Mims, typical of acid Low Hammock citrus soils. The basic or neutral soils selected were the Portsmouth loamy fine sand at Mims and Palm Beach sand at Vero Beach. The reactions of the acid and basic soils treated with single and double strength acid and basic fertilizers are reported in another paper at this meeting by Dr. A. E. Hughes.

The constituents as shown in Table I were selected for use in these experiments. All single strength acid and basic forming fertilizers obtain one-third of their nitrogen from organic sources. The double strength acid and basic forming fertilizers secure all their nitrogen from chemical sources. The equivalent acidity and basicity is in terms of calcium carbonate and is based on the reports of PIERRE (3) (4).

Table II shows the average of orange tree

*Prepared for presentation before the Florida State Horticultural Society by George M. Bahrt. Acknowledgment is made of suggestions of J. J. Skinner of the Bureau of Plant Industry, in charge of Soil Fertility Investigations in the Southeastern citrus and truck crop belt.

†In charge of Soil Fertility citrus and truck crop investigations in Florida.

## TABLE I

COMPOSITION AND ANALYSIS OF FERTILIZERS USED IN EXPERIMENTS

| Fertilizer Constituents | Treatment No. | Fertilizer Analysis N-$P_2O_5$-$K_2O$ | Equivalent Acidity per ton | Equivalent Basicity per ton | Equivalent Acidity per Unit N | Equivalent Basicity per Unit N |
|---|---|---|---|---|---|---|
| | | | Pounds of Calcium Carbonate | | Pounds of Calcium Carbonate | |
| | | Seasons | | 1931-35 | | |
| Urea | | 8-16-16 | 532 | ..... | 66.2 | ..... |
| Ammo-phos "A" | 1 | 6-16-10 | 461 | ..... | 76.8 | ..... |
| Sulphate of Potash | | 6-16-16 | 461 | ..... | 76.8 | ..... |
| Sand (Filler) | | | | | | |
| | | Seasons | | 1931-33 | | |
| Calurea | | | | | | |
| Triple Superphosphate | 2 | | | | | |
| Sulphate of Potash | | 8-16-16 | ..... | 297 | ..... | 37.1 |
| Ground Limestone | | 6-16-10 | ..... | 223 | ..... | 37.1 |
| Filler (Sand) | | 6-16-16 | ..... | 223 | ..... | 37.1 |
| | | Seasons | | 1933-35 | | |
| Calurea | | 8-16-16 | ..... | 802.4 | ..... | 100.3 |
| Triple Superphosphate | 2 | 6-16-10 | ..... | 608.2 | ..... | 101.4 |
| Sulphate of Potash | | 6-16-16 | ..... | 608.2 | ..... | 101.4 |
| Ground Limestone | | | | | | |
| Filler (Sand) | | | | | | |
| | | Seasons | | 1931-35 | | |
| Ammonium Sulphate, 2/3 of N. | | 4-8-8 | 305 | ..... | 76.2 | ..... |
| Tankage - - - - 1/6 of N. | 3 | 3-8-5 | 228 | ..... | 76.0 | ..... |
| Fish Scrap - - - 1/6 of N. | | 3-8-8 | 228 | ..... | 76.0 | ..... |
| Superphospate | | | | | | |
| Sulphate of Potash | | | | | | |
| Filler (Sand) | | | | | | |
| | | Seasons | | 1931-35 | | |
| Sodium Nitrate - - 2/3 of N. | | 4-8-8 | ..... | 401.2 | ..... | 100.3 |
| Dried Blood - - - 1/6 of N. | 4 | 3-8-5 | ..... | 304.1 | ..... | 101.4 |
| Steam Bone Meal - 1/6 of N. | | 3-8-8 | ..... | 304.1 | ..... | 101.4 |
| Superphosphate | | | | | | |
| Sulphate of Potash | | | | | | |
| Filler (Sand) | | | | | | |

### FERTILIZER APPLICATIONS

(Three per year)

| Double Strength Fertilizer | | Pounds per Tree 1931-32 | Pounds per Tree 1934-35 | Single Strength Fertilizer | | Pounds per Tree 1931-32 | Pounds per Tree 1934-35 |
|---|---|---|---|---|---|---|---|
| Treatments Numbered 1 and 2 | | | | Treatments Numbered 3 and 4 | | | |
| Spring | 8-16-16 | 3 | 5 | Spring | 4-8-8 | 6 | 10 |
| Summer | 6-16-10 | 3 | 5 | Summer | 3-8-5 | 6 | 10 |
| Fall | 6-16-16 | 5 | 7 | Fall | 3-8-8 | 10 | 14 |

Soil Amendments—three application per year: Manganese sulphate, 2 pounds per tree; copper sulphate, nickel sulphate, zinc sulphate, magnesium sulphate and ferrous sulphate, each 1/8 of a pound per tree.

yields and the average chemical analysis of fruit from trees grown on two basic and two acid soils for two crop years each.

ACID SOILS

In general the effect of manganese sulphate used in conjunction with fertilizers on the acid soils was to increase the yield of oranges. In three of the four treatments greater yields resulted from the use of manganese sulphate. There is an appreciable increase in the manganese content of the oranges resulting from the addition of manganese sulphate to the soil. However, its effect on the iron content of the fruit is variable and generally no appreciable increase is noted.

The use of copper sulphate in conjunction with fertilizers on these acid soils did not result in any appreciable increased yields. In two instances the yields were depressed. Nor was there any appreciable difference in the composition of the fruit resulting from the addition of copper sulphate to the soil.

The combined use of the sulphates of copper, zinc, nickel, magnesium, iron and manganese, in conjunction with fertilizers on the acid soils, resulted in increased yields in three trials out of four. There was an increase in the manganese content of the fruit, and an increase in iron in three of the four trials. In Table II, where the average yields and analytical data are given, the symbols indicate a decrease or increase in yield of chemical and biological constituents of the fruit resulting from the use of manganese, copper and all the soil amendments combined. A more detailed discussion follows. However, a study of the table is necessary to get the full significance of the treatments.

When single and double strength acid and basic forming fertilizers were applied to acid soils the greatest yield and highest amount of potash in the fruit were obtained from treatments consisting of single strength basic fertilizer. The greatest amounts of juice, ash and calcium in the fruit were obtained from single strength acid forming fertilizer while the highest percentage of iron was from the double strength basic forming fertilizer.

Data from four treatments on acid soils, including single strength acid forming fertilizer only, fertilizer plus copper sulphate, fertilizer plus manganese sulphate, and fertilizer plus manganese, copper, nickel, zinc, magnesium and ferrous sulphates, showed that the highest yield was from the treatment in which all of the soil amendments were included in the fertilizer. Fertilizer containing copper gave the lowest yield and a decrease in manganese and total solids in the fruit as compared to fruit grown with fertilizer only, but showed an increase in calcium and iron. Manganese added to the fertilizer tended to increase the nitrogen and manganese contents of the fruit.

When comparing the results of the single strength basic forming fertilizer alone, on acid soils, with the fertilizer plus copper, the fertilizer plus manganese, and the fertilizer plus manganese, copper, nickel, zinc, magnesium and ferrous sulphates, it was found that the greatest yield was obtained where the fertilizer was applied alone. When the soil amendments were added in addition, there was an increase in ash content of the fruit. Copper increased the acidity, potash and iron, but decreased the amount of juice. Manganese sulphate used with fertilizer increased the amount of juice, manganese, total soluble solids, and pulp, but decreased the acid content of the fruit.

On the acid soils double strength acid forming fertilizer plus manganese sulphate gave the highest yield. Fertilizer with copper showed a decrease in manganese content of the fruit but gave the highest percentage of calcium and magnesium. Fertilizer with all of the amendments produced fruit with less rind and pulp and with the highest per cent. of juice.

Of the treatments consisting of double strength basic forming fertilizer alone, fertilizer plus manganese sulphate, fertilizer plus copper, and fertilizer plus copper, nickel, zinc, magnesium, ferrous and manganese sulphates, the largest yield and highest per cent. of manganese in the fruit were obtained from the plot treated with fertilizer plus manganese. Copper decreased the iron content and rind of the fruit but produced fruit containing the most juice. Fruit from the treatment where all the soil amendments were added contained the least acid.

## TABLE II

AVG. ANALYSIS OF VALENCIA ORANGES OBTAINED FROM ACID AND BASIC SOILS TREATED WITH SINGLE AND DOUBLE STRENGTH ACID AND BASIC FERTILIZERS WITH AND WITHOUT SOIL AMENDMENTS

a: Yield per tree

| | Single Strength Fertilizer | | Double Strength Fertilizer | | Single Strength Fertilizer | | Double Strength Fertilizer | |
|---|---|---|---|---|---|---|---|---|
| | Acid Forming | Basic Forming | Acid Forming | Basic Forming | Acid Forming | Basic Forming | Acid Forming | Basic Forming |
| | Acid Soils — Fertilizer Only | | | | Acid Soils—Fertilizer+Manganese Sulphate | | | |
| Yields—Pounds [a] | 113. | 155. | 136. | 115. | I 116. | D 80. | I 172. | I 147. |
| Juice ..... % | 64.67 | 64.257 | 61.84 | 64.105 | D 62.87 | I 65.48 | * 61.84 | I 64.375 |
| T. S. Solids ..... % | 14.265 | 14.362 | 13.7087 | 14.203 | I 14.275 | I 14.737 | I 19.3115 | D 13.955 |
| Acid ..... % | 1.314 | 1.299 | 1.306 | 1.340 | D 1.259 | D 1.250 | I 1.317 | D 1.199 |
| Rind ..... % | 17.125 | 17.562 | 18.345 | 16.9775 | I 18.015 | D 16.18 | D 18.240 | I 17.087 |
| Pulp ..... % | 18.707 | 18.21 | 13.80 | 18.905 | I 19.105 | I 18.375 | D 18.48 | D 16.03 |
| Ash ..... % | .78725 | .72275 | .71015 | .7125 | D .7242 | I .7396 | D .6842 | I .71.80 |
| N ..... % | .1122 | .1268 | .13365 | .1329 | I .1248 | I .1417 | D .1265 | D .1312 |
| $P_2O_5$ ..... % | .06175 | .0694 | .0696 | .0724 | I .0672 | I .0660 | D .0634 | D .0635 |
| CaO ..... % | .1335 | .1117 | .1136 | .1188 | D .1230 | I .1217 | D .1131 | D .1184 |
| $K_2O$ ..... % | .27515 | .30325 | .2666 | .2814 | D .2693 | I .3138 | I .3210 | D .2562 |
| MgO ..... % | .02755 | .02685 | .0265 | .0273 | D .0247 | I .0269 | D .0259 | D .0266 |
| $Fe_2O_3$ ..... P. P. M. | 6.384 | 6.3405 | 5.660 | 7.394 | D 5.7625 | I 6.973 | I 6.124 | D 6.6315 |
| $Mn_3O_4$ ..... P. P. M. | 1.061 | 1.116 | 1.3635 | 1.23325 | I 2,3170 | I 3.994 | I 2.406 | I 3.6420 |
| | Acid Soils—Fertilizer+Copper Sulphate | | | | Acid Soils—Fert.+Cu., Ni., Zn., Mg., Fe. and Mn. Sulphates | | | |
| Yields—Pounds | D 97. | D 90. | I 137. | I 117. | I 123. | D 99. | I 141. | I 120. |
| Juice ..... % | D 63.713 | D 63.302 | I 63.302 | I 64.837 | D 62.935 | D 63.93 | I 63.54 | D 61.370 |
| T. S. Solids ..... % | D 14.2225 | D 14.256 | I 14.073 | D 13.906 | I 14.35 | I 14.406 | I 19.573 | D 13.785 |
| Acid ..... % | D 1.3028 | I 1.333 | I 1.3375 | D 1.327 | D 1.2235 | D 1.266 | D 1.273 | D 1.1775 |
| Rind ..... % | D 16.476 | I 17.807 | D 18.1375 | D 16.64 | I 17.887 | I 17.6925 | D 18.10 | I 18.355 |
| Pulp ..... % | I 18.7925 | I 18.887 | D 18.596 | D 18.50 | I 18.845 | I 18.865 | D 16.072 | I 20.265 |
| Ash ..... % | D .7518 | I .7423 | I .7620 | I .7347 | D .6940 | I .7868 | D .7095 | D .7110 |
| N ..... % | I .1297 | I .1325 | D .1315 | D .1301 | I .1400 | D .1254 | D .1281 | I .1366 |
| $P_2O_5$ ..... % | I .0669 | I .0628 | D .0685 | D .0610 | D .0703 | D .0652 | D .0584 | D .0628 |
| CaO ..... % | I .1422 | I .1303 | I .1417 | D .1115 | D .1095 | I .1383 | I .1317 | I .1128 |
| $K_2O$ ..... % | I .2818 | D .3305 | I .2983 | I .2820 | I .3042 | D .2710 | I .2690 | I .2612 |
| MgO ..... % | D .0269 | D .0260 | I .0301 | D .0250 | D .0239 | D .0242 | I .0275 | D .0264 |
| $Fe_2O_3$ ..... P. P. M. | I 7.105 | I 7.7800 | D 6.3570 | D 6.7775 | I 6.8460 | I 7.0400 | D 5.2425 | D 7.0810 |
| $Mn_3O_4$ ..... P. P. M. | D 1.0440 | I 1.3170 | D 1.3440 | D 1.1280 | I 2.1575 | I 3.2485 | I 1.6720 | I 2.2170 |

TABLE II—(Continued)

| | Basic Soils—Fertilizer Only | | | | Basic Soils—Fertilizer+Manganese Sulphate | | | |
|---|---|---|---|---|---|---|---|---|
| Yields—Pounds | 168. | 131. | 86. | 124. | D 152. | I 164. | I 137. | I 186. |
| Juice ..... % | 61.14 | 60.59 | 60.28 | 64.105 | I 61.41 | D 58.4 | I 60.96 | D 59.00 |
| T. S. Solids ..... % | 13.387 | 13.03 | 13.52 | 14.203 | D 13.137 | I 13.15 | D 13.40 | I 13.14 |
| Acid ..... % | 1.067 | 0.953 | 1.27 | 1.340 | D 1.062 | I 1.137 | I 1.987 | D 1.14 |
| Rind ..... % | 17.67 | 20.47 | 19.02 | 16.9775 | I 18.35 | D 19.14 | D 18.89 | I 19.70 |
| Pulp ..... % | 19.95 | 18.91 | 20.69 | 18.905 | I 20.19 | I 22.53 | D 20.09 | I 21.26 |
| Ash ..... % | .6628 | .6500 | .6261 | .6910 | I .7041 | I .7026 | I .6065 | D .6750 |
| N ..... % | .1323 | .1453 | .1435 | .1342 | I .1639 | D .1195 | I .1542 | I .1648 |
| $P_2O_5$ ..... % | .060 | .058 | .065 | .045 | I .063 | I .064 | D .062 | I .063 |
| CaO ..... % | .145 | .092 | .108 | .103 | I .148 | I .108 | D .119 | I .147 |
| $K_2O$ ..... % | .247 | .245 | .241 | .246 | D .222 | I .270 | D .231 | D .230 |
| MgO ..... % | .0260 | .0210 | .0199 | .0196 | D .0249 | I .0253 | D .0189 | I .0226 |
| $Fe_2O_3$ ..... P. P. M. | 3.875 | 2.770 | 4.1340 | 1.837 | D .969 | I 6.379 | D 3.208 | I 2.988 |
| $Mn_3O_4$ ..... P. P. M. | 0.708 | 0.682 | 0.676 | 0.670 | I .1.280 | I 1.195 | D 0.594 | I 1.072 |

| | Basic Soils—Fertilizer+Copper Sulphate | | | | Basic Soils—Fert.+Cu., Ni., Zn., Mg., Fe. and Mn. Sulphates | | | |
|---|---|---|---|---|---|---|---|---|
| Yields—Pounds | D 146. | * 131. | D 80. | I 149. | D 95. | D 118. | I 170. | I 173. |
| Juice ..... % | I 62.97 | D 60.31 | D 59.86 | D 59.8 | I 62.77 | D 59.67 | I 61.61 | D 60.0 |
| T. S. Solids ..... % | D 13.378 | I 13.27 | D 12.89 | I 13.14 | D 13.015 | I 13.53 | D 13.288 | D 13.51 |
| Acid ..... % | I 1.1430 | I 1.142 | D 1.084 | D 1.08 | I 1.136 | I 1.179 | I 1.296 | D 1.148 |
| Rind ..... % | I 17.78 | D 18.31 | D 18.86 | I 18.97 | D 17.59 | D 18.55 | D 17.40 | I 19.60 |
| Pulp ..... % | D 19.78 | I 20.91 | I 21.23 | I 21.73 | D 19.63 | I 21.78 | I 21.23 | I 20.91 |
| Ash ..... % | D .6325 | I .6650 | I .6378 | D .6642 | D .5923 | D .6400 | I .6503 | D .6572 |
| N ..... % | D .1309 | D .1331 | D .1273 | I 1384 | D .1180 | D .1251 | D .1220 | I .1380 |
| $P_2O_5$ ..... % | D .058 | I .062 | I .067 | I .064 | I .064 | I .064 | D .060 | I .061 |
| CaO ..... % | D .096 | I .133 | I .123 | I .133 | D .090 | I .115 | I .137 | D .096 |
| $K_2O$ ..... % | D .220 | I .250 | I .282 | I .280 | D .240 | I .310 | I .300 | I .319 |
| MgO ..... % | D .0231 | D .0209 | D .0192 | I .0242 | D .0224 | D .0209 | I .0212 | I .0243 |
| $Fe_2O_3$ ..... P. P. M. | D 3.562 | I 3.118 | D 2.877 | I 3.341 | I 5.198 | I 4.277 | D 2.840 | I 2.864 |
| $Mn_3O_4$ ..... P. P. M. | I .796 | I .984 | I .834 | I .808 | I 1.070 | I 1.473 | I .922 | I 0.831 |

*Neither increase nor decrease over treatment with FERTILIZER ONLY.
I: Increase over treatment with FERTILIZER ONLY.
D: Decrease under treatment with FERTILIZER ONLY.

BASIC SOILS

On the basic soils manganese sulphate used with fertilizers resulted in increased yields in three cases, but when used with single strength acid forming fertilizer the yield was depressed. Its effect was to increase the manganese content of the fruit, except when used with the double strength acid forming fertilizer. There was but little variation in the other mineral constituents of the fruit resulting from its use. The effect of copper sulphate on yield was variable and in only one case was there an increased yield resulting from its use, nor was there any decisive influence on the composition of the fruit on these soils. The effect of including all the soil amendments in the fertilizer was to increase the manganese content of the fruit. A more detailed discussion follows.

Where single and double strength acid and basic forming fertilizers were applied on basic soils the single strength acid forming fertilizer produced the highest yield. Double strength basic forming fertilizer produced fruit containing the highest percentage of juice, total solids and ash, and the least rind. Of the treatments consisting of single strength acid forming fertilizer only, fertilizer plus manganese, fertilizer plus copper, and fertilizer plus all the amendments, the fertilizer alone produced the highest yield and the fruit contained the lowest percentage of juice. Fertilizer with manganese yielded fruit containing the most ash, manganese, rind and pulp, but the least iron. Copper with fertilizer decreased the ash content of fruit yet produced the highest percentage of juice.

Of treatments on basic soils consisting of single strength basic forming fertilizers only, fertilizer plus manganese, fertilizer plus copper, and fertilizer plus all the amendments, the fertilizer with manganese gave the highest yield and fruit containing least juice. Copper produced fruit having least rind and the most calcium.

When comparing the results of the double strength basic forming fertilizers on basic soils with fertilizer plus manganese, fertilizer plus copper and fertilizer plus all the amendments, the greatest yield was obtained from the plot receiving fertilizer and manganese. This plot also produced fruit containing the highest per cent. of rind, calcium, manganese and nitrogen. Fertilizer with copper produced fruit containing the most iron while fertilizer with all the amendments gave fruit containing the highest per cent. of potash and magnesium.

Table III contains data showing the effect of fertilizers and fertilizers with manganese sulphate on the color of juice of tangerines grown on acid and neutral soils. The juice from tangerines grown on soil to which manganese was added was cadmium orange as compared with cadmium yellow where manganese was not added. The juice of oranges grown on soil to which manganese was added had a slightly deeper color but was not as marked as in tangerines. This result was not apparent until the second year after the manganese was applied.

Table IV shows the average analysis of Valencia oranges grown on the Norfolk fine sand, Low Hammock phase and the Norfolk fine sand,

TABLE III

EFFECT OF MANGANESE SULPHATE ADDED TO THE SOIL ON COLOR* OF JUICE OF TANGERINES

| Soil Type and Location | Soil Reaction pH | COMPLETE FERTILIZER | |
|---|---|---|---|
| | | Only | With Manganese Sulphate |
| Norfolk Fine Sand "Rolling Phase" Polk County | 5.3 | Cadmium Yellow | Cadmium Orange |
| Norfolk Fine Sand Gainesville Phase Brevard County | 6.8 | Cadmium Yellow | Cadmium Orange |

*Based on Ridgeway's Color Standards and Nomenclature.

Rolling phase. Oranges from the Low Hammock phase contained more juice, total soluble solids, ash, nitrogen, calcium, potash, and iron, but less manganese and pulp.

TABLE IV

AVERAGE ANALYSIS OF VALENCIA ORANGES GROWN ON DIFFERENT SOILS

| | ACID SOILS | |
|---|---|---|
| | Single Strength Acid Fertilizer | |
| | Norfolk Fine Sand Low Hammock Phase | Norfolk Fine Sand Rolling Phase |
| Yields—In Pounds Per Tree | 135.0 | 91.0 |
| Juice % | 66.34 | 63.00 |
| T. S. Solids % | 14.33 | 14.20 |
| Acid % | 1.218 | 1.410 |
| Rind % | 16.01 | 18.24 |
| Pulp % | 17.66 | 18.76 |
| Ash % | .8175 | .7570 |
| N % | .1188 | .1056 |
| $P_2O_5$ % | .0741 | .0494 |
| CaO % | .1504 | .1166 |
| $K_2O$ % | .2913 | .2590 |
| MgO % | .0289 | .0262 |
| $Fe_2O_3$ P. P. M. | 8.460 | 4.128 |
| $Mn_3O_4$ P. P. M. | 0.4420 | 1.680 |

SUMMARY

On acid soils single strength base forming fertilizer gave larger yields of oranges than double strength acid forming or base forming fertilizers or single strength acid forming fertilizers. On basic soils the single strength acid forming fertilizer gave the highest yield.

Manganese sulphate used with double strength acid and basic forming fertilizers, and applied to acid and basic soils, generally increased the yield over fertilizer alone, but when used with single strength fertilizers, the results are not decisive. There were the same number of increases as decreases on acid and basic soils. In most cases when manganese was added to a fertilizer there was an increase in manganese content of the fruit and in rind. Manganese added to soils increased the intensity of color in the rind and juice of tangerines. Tangerine juice was cadmium orange where manganese was applied as compared with cadmium yellow where none was added.

The addition of copper to the fertilizer had no marked effect on the composition of oranges, nor did it increase the yield.

The combined use of the sulphates of copper, nickel, zinc, iron, magnesium and manganese in fertilizers generally resulted in an increased manganese and iron content of the fruit.

Valencia oranges grown on Norfolk fine sand, Low Hammock phase, contained more juice, ash, nitrogen, calcium and iron and yielded higher than Valencia oranges grown on Norfolk fine sand, rolling phase. The latter contained more rind pulp and manganese.

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(3) Pierre, W. H. Determination of Equivalent Acidity and Basicity of Fertilizers. Journal Ind. Eng. Chem., Vol. 5, No. 4, July 15, 1933.

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Question: Will you tell us something about the equivalent acidity of that fertilizer and this one?

Answer: Fertilizers used in these experiments include acid and basic fertilizers in single and double strength.

Mr. Ward: How do you account for the drop in 1933?

Answer: Rainfall, many things may cause variation. Compare this graph with the previous graph wherein on the same soil we placed basic fertilizer, and we have a general trend downward.

Question: Do you notice any difference in the response of the trees?

Answer: You recall that when we put single strength fertilizer on basic soil we got the highest yield. When we applied the various forms of fertilizer, not only single, but double strength, on the basic soil, we got the highest yield from single strength acid. We got the highest yield on basic soil from single basic. Therefore there is some correlation.

Question: Have you made any experiments at all on soils that are basically alkaline?

Answer: This paper here is just one of the high spots out of innumerable experiments. We can't report all of our experiments here. This is just some of the best. There is data to that effect.

Question: In view of the fact that that pH scale is not the fact, isn't there just as much change?

Answer: The potential change might be just about as much as far as the general difference is concerned. What I am trying to do here is just to show the increase over the four years.

Question: Isn't it true that five is ten times as acid as six?

Answer: Yes.

Mr. Brown: Last night I was very much interested in the very illuminating article presented by Mr. Case. It was the first I had heard about the proposed citrus legislation. I want you to know that Mr. Wilson, Mr. Ball and myself have no fight with this proposed legislation for advertising citrus fruits. However, Mr. Case, apparently, is not well informed about the work of the institute. It has always been a public matter, financed entirely by these two men, the same men who, with you behind them, made a success of the Fair, who now think they have, through experiment and actual test, found a way to help out the citrus industry and far be it from either of them to have any opposition to this legislative program which we all are ready to help, if that is the proper procedure. I did not find any provision for research. I don't know how you can advertise a product unless you just say, "Let's eat tangerines," unless you can give some sound reason why tangerines should be used. I think it would be advisable if a number would wire our senators and representatives, asking that provision be made for the necessary research to do constructive advertising in this bill.

We brought to Florida a number of men through the Citrus institute, who, I think, can be of immense value in the work of this commission, if we can prevail upon them to stay. One is Ross Bartley, head of the publicity department of the World's Fair; one is Mr. Davis, credited with bringing the millions of people who saw the Fair. He was commercial attache of the American Embassy in London and today occupies a very high position among the publicity people of the United States. Another was Colonel Miller, general manager of the advertising for the International Harvester Company, who brought together the warring elements of Chicago and brought it out of meat packing circles and made it one of the financial centers of the world. The Citrus Institute, if there is any trouble with the legislation, that it doesn't get through or for some reason is not put through, is ready to step in and help put it over. The sole idea behind Mr. Wilson, Mr. Ball and myself is to make citrus a staple article of diet for the American people and get it back on a paying basis for everybody.

Dr. Barnes: Since coming here—I don't know whether Mr. Sexton thought I was an extra good doctor or not—but he showed me some grapefruit in his grove. One was a nice shiny one, the other kind of rough. He asked me what I though about it. I said perhaps the rough grapefruit had "pellagra." Maybe I am not quite as bad as you might think at diagnosis.

We found a substance—six in fact—that are called vitamins, that are very essential to bodily economy. Maybe we will find some other substances essential to the economy of trees. I am quite certain we will. I do know that we tried to raise alfalfa one year and it didn't work. We tried three or four years and finally we came in contact with some agriculturist from over at the

University and he told us we didn't have the right kind of bacteria in our soil. He gave us some and we have been growing alfalfa ever since. I am mentioning it in passing that bacteria are valuable to the soil.

Dr. Ruprecht: I want to call attention to Bulletin No. 27, which contains analysis of oranges and tangerines.

Dr. Barnes: May I ask if the position I took here is correct?

Dr. Ruprecht: I could not say offhand. I don't know—maybe Mr. Sexton is doing something to his particular citrus fruits that is a little different.

Dr. Barnes: It was very astounding to me to find that very wide difference. However, I have found in analysis where you find wide differences.

Lady from Floor: I think this paper is so very valuable that we would like to have a copy to read and think over it. I would like very much to have a copy of this valuable paper that this gentleman has given. Last year I was told all the papers would be printed in the Proceedings and I would receive a copy, but I never got any.

The audience was assured that all papers would be printed in the proceedings and sent to members.

## THE EFFECT OF ACID AND NON ACID FERTILIZERS ON NORFOLK FINE SAND

**R. W. Ruprecht and C. E. Bell***
**Agricultural Experiment Station, Gainesville**

In view of the renewed interest in the influence of fertilizers on soil reaction some observations which we have made in connection with the source of nitrogen experiment on citrus at our Citrus Experiment Station at Lake Alfred might be of interest. In this experiment which has been under way twelve years, nitrate of soda, sulfate of ammonia and dried blood are compared as the sole sources of nitrogen. In the first series all plots received the same amount of phosphoric acid from superphosphate and potash from sulfate of potash. In the second series of plots the phosphoric acid was derived from steamed bone meal which in addition also supplied about one-half of the nitrogen, and the potash from sulfate of potash.

During the time this experiment has been under way each tree of series one in the sulfate of ammonia plot has received a total of 39.6 lbs. of sulfate of ammonia. The trees in the nitrate of soda plot have each received 55.0 lbs. of nitrate of soda, and the trees in the dried blood plot 61.9 lbs. of dried blood, while the trees in the fourth plot each received 28.25 lbs. of dried blood, 14.9 lbs. of nitrate of soda and 10.75 lbs. of sulfate of ammonia.

Disregarding the effect that the superphosphate might have had on the soil reaction these amounts of nitrogen compounds would have produced an acidity or alkalinity as follows, using Pierre's values for the various nitrogen materials. The 39.6 lbs. of sulfate of ammonia would have produced an acidity equivalent to 43.56 lbs. of calcium carbonate. The 61.9 lbs. of dried blood, an acidity equivalent to 14.11 lbs. of calcium carbonate, while the 55.0 lbs. of nitrate of soda would have produced an alkalinity equivalent to 15.84 lbs. of calcium carbonate, and the combination of blood, nitrate of soda and sulfate of ammonia used on plot 4 would have produced an acidity equivalent to 13.97 lbs. of calcium carbonate.

Superphosphate is disregarded in arriving at these figures as according to our best information this material has very little influence on the soil reaction.

In the second series, plots 6 to 9 which received steamed bone meal as the source of phosphoric acid and about half the nitrogen, the nitrogen and bone meal would have had the follow-

*Chemist and Head of Department and Associate Chemist, respectively.

ing effect on the soil: In plot 6 nitrate of soda and bone meal would have produced a total alkalinity equivalent to 121.27 lbs. of calcium carbonate per tree; the sulfate of ammonia and bone on plot 7 would have produced an alkalinity equivalent to 95.50 lbs. calcium carbonate. In plot 8 the dried blood and bone would have produced an alkalinity equivalent to 107.29 lbs. of calcium carbonate, while the nitrate of soda, sulfate of ammonia and bone meal on plot 9 would have produced an alkalinity equivalent to 109.45 lbs. of calcium carbonate.

Soil samples were taken from each of these plots in 1923, 1930, 1932 and 1934 in approximately the same spots in the same manner. The results of the chemical analysis are shown in Table 1.

TABLE I

SOIL REACTION AND LIME REQUIREMENT

| | | 1923 | 1930 | 1932 | 1934 | 1935 | Lime Req. |
|---|---|---|---|---|---|---|---|
| 1 | Top. | 5.50 | 5.38 | 4.88 | 5.39 | 5.06 | 833 |
| | Sub. | 5.67 | 5.51 | 5.05 | 5.23 | 5.18 | 648 |
| 2 | Top | 5.84 | 4.94 | 4.41 | 4.80 | 4.62 | 1323 |
| | Sub. | 5.67 | 4.93 | 4.58 | 4.48 | 4.50 | 927 |
| 3 | Top | 5.75 | 5.04 | 4.63 | 4.95 | 4.70 | 864 |
| | Sub. | 5.67 | 5.23 | 4.71 | 4.86 | 4.73 | 725 |
| 4 | Top | 5.67 | 5.11 | 4.46 | 4.83 | 4.68 | 990 |
| | Sub. | 5.75 | 5.29 | 4.88 | 4.80 | 4.68 | 630 |
| 6 | Top | 6.01 | | 5.22 | 5.56 | 5.22 | 680 |
| | Sub. | 5.92 | | 5.26 | 5.50 | 5.25 | 526 |
| 7 | Top | 5.84 | | 5.00 | 5.06 | 5.25 | 932 |
| | Sub. | 5.75 | | 4.83 | 5.00 | 5.11 | 756 |
| 8 | Top. | 5.67 | | 5.05 | 5.27 | 5.11 | 765 |
| | Sub. | 5.84 | | 4.97 | 5.20 | 5.22 | 558 |
| 9 | Top | 5.84 | | 5.00 | 5.30 | 5.22 | 720 |
| | Sub. | 5.84 | | 4.97 | 5.13 | 5.22 | 540 |

Taking first the pH or soil reaction of the surface soils we find as follows: In plot 1, the nitrate of soda plot, the reaction has changed very little from 5.50 in 1923 to 5.06 in 1935. In plot 2, the sulfate of ammonia plot, the change has been from 5.84 to 4.62. Plot 3, dried blood, has changed from 5.75 to 4.70, and plot 4, the combination sources of nitrogen, have brought about a change from 5.67 to 4.68. In the series of plots receiving steamed bone meal as the source of phosphoric acid and part of the nitrogen, the changes have been as follows: Plot 6, nitrate of soda from 6.01 to 5.22. Plot 7, sulfate of ammonia, 5.84 to 5.25. Plot 8, dried blood, from 5.67 to 5.11 and plot 9, combination of sources, from 5.84 to 5.22.

The changes in the subsoil were the same as in the surface soil.

It will be noted that despite the fact that theoretically plots 1 and all of the bone plots should have had a lower acidity as they received a fertilizer leaving a basic residue in the soil, the acidity in all cases was slightly increased. As was to be expected, plot 2, receiving sulfate of ammonia, changed the most. You will note, however, that plots 3 and 4 have developed almost as great an acidity as in plot 2.

Another measure of soil acidity is the lime requirement of the soil. The last column of the table gives the lime requirement made according to the Jones method. Here we find in the superphosphate series that the lime requirement varies in the same way as the pH. Plot 2 has the highest and Plot 1 the lowest.

In the bone meal series the sulfate of ammonia, plot 7, has the highest lime requirement, the nitrate of soda, plot 6, the lowest, even though the pH values of these two plots is the same. We see that in the first series the use of the acid fertilizer, sulfate of ammonia, has only increased the lime requirement by about 500 lbs. per acre over the use of an alkaline material, nitrate of soda, after 12 years continuous use of these materials. In series 2 where bone meal was used the difference is even less.

We have always been taught that sulfate of ammonia removes lime from the soil, thus depleting the soil in this element. Let us look at Table 2 and see what has happened in this case. The figures show the amount of replaceable lime which is the lime theoretically available for plant use. Comparing the surface soil of the two columns we find first, that in Plot 1, nitrate of soda, there has been a decided increase in the lime content.

In the case of plot 2, sulfate of ammonia, there is just as much lime now as there was at the start. The same is true of plots 3 and 4.

TABLE II

PERCENT. OF REPLACEABLE BASES

| Plot | | Calcium oxide | | Magnesium oxide | | Potassium oxide | |
|---|---|---|---|---|---|---|---|
| | | 1923 | 1934 | 1923 | 1934 | 1923 | 1934 |
| 1 | Top | .015 | .030 | .0039 | .0029 | .0047 | .0035 |
| | Sub. | .008 | .012 | .0035 | | .0056 | .0019 |
| 2 | Top | .017 | .018 | .0046 | .0033 | .0052 | .0025 |
| | Sub. | .006 | .008 | .0038 | .0024 | .0048 | .0017 |
| 3 | Top | .016 | .018 | .0034 | .0025 | .0056 | .0028 |
| | Sub. | .006 | .011 | .0031 | .0024 | .0045 | .0016 |
| 4 | Top | .021 | .019 | .0038 | .0029 | .0060 | .0023 |
| | Sub. | .007 | .007 | .0033 | .0029 | .0054 | .0017 |
| 6 | Top | .023 | .039 | .0050 | .0040 | .0049 | .0036 |
| | Sub. | .008 | .011 | .0035 | .0027 | .0061 | .0022 |
| 7 | Top | .020 | .030 | .0043 | .0032 | .0043 | .0024 |
| | Sub. | .008 | .010 | .0033 | .0024 | .0044 | .0018 |
| 8 | Top | .019 | .035 | .0038 | .0033 | .0038 | .0028 |
| | Sub. | .006 | .013 | .0030 | .0026 | .0052 | .0049 |
| 9 | Top | .017 | .042 | .0038 | .0036 | .0069 | .0031 |
| | Sub. | .006 | .008 | .0030 | .0023 | .0064 | .0017 |

In the bone meal series there has been a distinct increase in lime in all of the plots. Turning now to the subsoil, we find a slight increase in all cases. While no lime as such has been added during the course of the experiment, all of the plots in series 1 have received some lime from the superphosphate as this material contains about 28% of calcium oxide, while those in series 2 have received even larger amounts in bone meal. Most of this is in the form of calcium sulfate in series 1, with the balance combined with the phosphoric acid, while in series 2 practically all is present as tri calcium phosphate.

During the course of the experiment each tree in series 1 has received about 37½ lbs. of lime or calcium oxide from the superphosphate. This lime, even though largely in the form of calcium sulfate, has been adequate to maintain the replaceable lime content at a constant level. Whether or not this level was high enough to supply the full needs of the tree cannot be stated.

In the next two columns we have the replaceable magnesium content of the soils. In every case there has been a decrease since the start of the experiment in both soil levels. As no source of magnesium was used at any time a decrease was to be expected. Apparently the source of nitrogen had no influence on the loss as the change is pretty much the same on all plots.

The last two columns show the percentage of replaceable potassium in 1923 and 1934. There has been a very decided loss in potassium in all cases with the greatest loss in the subsoil. This loss has taken place despite the fact that potash has been added three times each year for a total of 35¼ lbs. of sulfate of potash per tree. Here again apparently the source of nitrogen has had no influence on the loss as the relative losses are just as great with one source as another.

The source of phosphoric acid likewise, has not influenced the loss of potash. Undoubtedly a large share of this potash has been taken up by the tree and been carried off in the fruit. Whether this accounts for all the loss or whether some was lost through leaching still remains to be determined.

You practical growers are probably saying to yourselves—those figures are very interesting but just what do they mean to me. We think that they show, first—that sulfate of ammonia while it will increase the acidity takes a long time to bring the soil reaction down low enough to be dangerous. Second—that sulfate of ammonia will not seriously deplete the soil in lime if it is used with superphosphate or bone meal.

We are frank to admit that the trees in the various plots of series one are not in as good condition as those in series two, which have received bone meal. We are not as yet able to say whether this difference is due to the organic matter in the bone meal or to some other cause. Until about four years ago, the plots in series one were just about the same as those in series two. By referring to Table 1, it will be seen that it is since that date that the soil reaction in series one dropped below pH 5.0. We believe that had lime

been applied at that time to these plots the difference now apparent might not have developed.

In regard to the use of lime we wish to again warn you against using this material in excess. From information which we have received there is apparently considerable danger that many growers will use too much lime. For many years we, at the Experiment Station, had carefully avoided even mentioning lime to citrus growers, being mindful of the sad results of over-liming which took place about 1917 and 1918. Since soil reaction or pH-itis became so popular we have had to bring lime into the picture again. In all of our tolks and writings we have emphasized the danger of over-liming, yet today we find growers talking of applying a ton of limestone to the acre. For your grove's sake we again ask you not to apply more than 500 lbs. per acre at any one application and even this amount may be too much for some soils.

Closely allied with the use of lime at the present time is the use of the so-called rare elements, or less common elements. We at the Station are probably responsible for the interest manifested in these elements. Could we have foreseen the enthusiasm with which you growers have taken these elements to your groves, we might have refrained from mentioning them until we knew more about them. At this time I just wish to point out, that all of these less common elements are extremely toxic if present in too large amounts and unless you know that your soil needs the elements you are adding, it is much better not to use them.

We would advise the fertilizer manufacturers not to mix these elements with the usual fertilizer materials until we know more about the interaction between these elements and the fertilizer materials, and we would advise growers not to use mixed fertilizers to which such elements had been added unless they know that the extra elements are needed.

These remarks, of course, do not apply to the small amounts of these elements which may be present as impurities in the fertilizer materials.

Just by way of illustration we have this year found one of these elements which when used at the rate of ten pounds per acre is stimulating, yet when used at 20-30 lbs. per acre is distinctly toxic. As we have stated on numerous occasions the old adage—if a little is good, more is better—does not hold for these elements.

## INTERESTING NEW USES OF SOLUBLE BORATES IN THE PACKING HOUSES

**Richard M. Stewart, III, Winter Haven**

I would like to take the liberty of altering the wording of the subject assigned to me for discussion. I believe that "Interesting New Uses of Soluble Borates in the Packing Houses" more accurately describes what I shall have to say.

Before going into these new developments it would seem advisable to briefly review the past history and performance of borax as such, as used to control the various forms of decay which afflict our citrus fruit and give us so many headaches in the form of allowances and discounts. Under the market conditions which have prevailed over the past few seasons these discounts for decay have often meant the difference between a profit and red ink on a car shipment.

About ten years ago it was discovered that fruit dipped in a cold borax solution of from 3% to 5% concentration was far less susceptible to the mold decays than similar fruit not so treated. In fact, fruit so treated was practically immune to the ravages of blue or green mold. However, this treatment did not satisfactorily reduce stem-end rot, which after all is the boogie-man of the citrus decay family, as far as we Florida folks are concerned.

So, two seasons ago the United States Depart-

ment of Agriculture laboratories at Orlando conducted an extensive series of tests, using higher concentrations of borax. Much to the delight of all concerned, this was found to be highly effective in controlling stem-end decay. However, because of the low solubility of borax in cold water, it was found necessary to heat the solutions in order to hold the desired concentration, which the tests showed to be about 8%.

The bulletin issued by the Department of Agriculture J. R. Winston, Sept. 25 (1933) summarizing the results of this work, brought to light several other interesting points, to-wit: That among the many materials which had been tested, borax was certainly the most effective fungicide. That to gain the maximum in desired results from this treatment, fruit should be dipped in a warm 8% solution of borax immediately upon its arrival at the packing house, before the assorted and sundry fungi had the opportunity to entrench themselves too deeply to be reached. That a temperature ranging from 100° F to 110° F was necessary to keep the 8% concentration in solution. At lower temperatures the borax crystallized out rapidly. That while refrigeration, our former bulwark against decay losses, was effective only while fruit was in transit, a suitable borax treatment successfully retarded decay not only while in the packing house and in transit, but also during the further period normally required for distribution, retail sale and ultimate consumption.

As a result of these findings many packing houses throughout the state installed borax treating tanks on their receiving platforms, with results which were highly gratifying and looked very nice on the decay records. Occasional lapses from the recommended procedure on the part of some house managers usually brought a hurried return to use of the borax. They found it was not always possible to look at a crop just received at the house and accurately determine its resistance to decay. Bad guesses often proved costly. Along this line I am reminded of a conversation I had last week with the manager of one of the larger houses in the state. He told me that thinking to save a fraction of a cent per box he had ordered the discontinuance of the platform borax dip for a few days. To quote him, "Before I could turn around it had cost me $1200.00. I concluded that borax was blank blank cheap insurance!"

Repeated instances like this have resulted in the general acceptance of the fact that borax dipping, properly done, is our best standby in fighting decay. But changing conditions bring changing needs, and the weird season at hand, to whose conclusion we are all looking forward, has brought many changes.

Admittedly, there *have* been some fair objections to the use of borax treatment as heretofore described. The necessity of heating the tanks, and keeping them warm even while shut down, to avoid the crystallization of the borax on the tank walls and conveyors has resulted in some trouble and indirect expense. This crystallizing habit of borax when tank temperatures are lowered is indeed annoying, for it is difficult in the extreme to redissolve it upon resumption of operations. Furthermore, it has been realized to an increasing extent that the heating of fruit certainly does it no good, and quite often has an undesirable effect on quality. Since the advent of the coloring processes so widely adopted this season, and which unavoidably require some heating, it seems more than ever desirable to avoid other heat processes wherever possible.

To this end the Orlando Government Laboratories, co-operating with the Florida Citrus Exchange, has for over a year been conducting tests on various borates which are more soluble than borax in cold water. While not yet released for publication, the trend of these tests have been available to packing house operators. Following preliminary work in the laboratory, the tests were continued on a commercial scale. They caused the packing house operators to become highly interested in the advantages offered by the use of alkaline borates which had been found to be adequately soluble in cold water. However, no such borates were commercially available at a price which the packing houses could well afford to pay.

The American Potash and Chemical Corporation, because of its facilities for economically producing various borates, was approached by certain packing house operators, and following a series

of co-operative tests, has developed a new material which fully equals borax as to fungicidal efficiency, and has marked advantages over borax in regard to cold water solubility and other properties. This material is now being produced and marketed under the name of "METBOR."

Commercial production and sale of "METBOR" was not started until its effectiveness had been thoroughly demonstrated. Its performance has been notable in one of the largest packing houses in the state. The decay record of the house in question was none too good, but the consistent use of Metbor solutions, used in place of water in their light fruit separators, and in the soak tanks has reduced their decay losses to a negligible figure. In fact, the operation over the last ten weeks has shown a reduction in decay of well over 90% as compared to the preceding ten weeks record.

The principal ingredient in Metbor is sodium metaborate, which is made from borax. The composition has been somewhat adjusted to meet the requirements of economical production and most satisfactory properties for packing house use. It is quickly and completely soluble in cold water to concentrations even greater than are necessary to gain the equivalent of an 8% borax solution. All tests which have been reported have indicated that the boric oxide content of borax, or other borate compounds, is the chief determining factor in control of decay. Cold solutions of Metbor containing boric oxide equivalent to that of 8% borax have been found fully as efficient as the warm solutions of the latter.

This new material possesses none of the objectionable qualities of borax. As no heat is required to keep the necessary concentration in solution, a saving in fuel is effected, and there is no tendency whatsoever toward crystallization. The mixing of solutions in the tanks is easily and quickly accomplished. There is not the marked and objectionable odor which develops in borax solutions, for Metbor solutions stay sweet during long periods of use.

One of the most interesting uses for Metbor, under conditions existing this season, is in connection with handling frost damaged fruit in light fruit separators. Practically all marketable fruit has been affected to some extent by the freeze, about which I am sure you have all heard, and certainly requires the protection of a borate treatment. Most packing houses have installed these separators, but few of the tanks are equipped with heating coils. In any case the large volume and rapid circulation of the liquid would entail a heavy fuel cost to maintain the temperature necessary to hold 8% borax in solution. Metbor solutions have been successfully used in separator tanks, and have made it possible to combine effective separation of frosted fruit with effective control of decay in the marketable fruit.

In addition to the desirable properties I have mentioned, the composition of Metbor makes it a very efficient cleaner. Its use in the soak tank gives the combined advantages of effective cleaning and additional borate protection. As most houses which have installed color processes have been forced, by need for space, to remove the second borax tank (following the scrubbing brushes) in which heretofore warm borax solutions have been used, the introduction of a borate into the first tank overcomes the deficiency.

# THE RELATIONS OF THE STATE PLANT BOARD WITH THE HORTICULTURAL INDUSTRY IN FLORIDA

**Hon. George H. Baldwin, Jacksonville**

I accepted the very gracious invitation of your Secretary to appear on your program here today with considerable trepidation for to one who is not engaged in Horticultural work the word "Horticulture" takes in such a large and complex field that I was afraid I might find a group composed only of bespectacled scientists to whom I felt I might have very little of any interest to say. I find, however, that whether you are scientists or not you all appear to be very human and have been exceedingly cordial in your greetings to me. I come to attempt to express to you possibly very inadequately, but none the less most sincerely, the view of the gentlemen who form the State Plant Board and hope that from this appearance you will see that we are also very human. The members of the Board feel very deeply the responsibility resting on our shoulders when one realizes that the welfare of the entire agricultural industry of this State may be jeopardized by lack of interest or neglect of our duty and it makes us take these duties very seriously. This is borne in on us by the fact it is estimated that the capital investment in agriculture in Florida is in excess of $1,000,000,000. Of this of course the probably $500,000,000 in citrus is by far the largest item, including groves, packing houses, crate mills, canning plants, machinery and other accessories. There are other items, however, of large figures such as the $3,000,000 production of our nurseries, the nearly $27,000,000 value of vegetables, the $47,000,000 of fruits and nuts for the year 1929 according to the U. S. Census Bureau and the estimated gross return of nearly $53,000,000 for the 1929-30 citrus crop. Gentlemen, I assure you that we take our responsibility for this great industry and to you as fellow citizens very seriously.

The duties of the State Plant Board as we see them are first to hold to a minimum the loss due to pests which are already here and, second, to prevent introduction and dissemination of additional pests.

To carry out these duties we, and our predecessors in office, have tried since the formation of this Board to make as few rules and as simple rules as possible; to set up an organization of as few individuals as possible but to pick for that organization men who not only have the necessary technical training but who have the judgment to properly apply the rules; and finally to insist that our rules be lived up to by everyone without fear or favor.

We believe we have a courteous, loyal and capable organization from Dr. Newell down to the newest inspector and I can truthfully say I have never personally seen a better morale in any organization with which I have ever been connected.

Of course a great part of our work is in the nature of police work. This of itself will certainly from time to time make us very unpopular with those who are not willing to co-operate in our work for the benefit of the whole. If I think the speed limit in my home town is too low, or if I think I have a good justification for exceeding it, or if I just don't care, and am pulled in by a speed cop for not conforming to the speed limit rule, that cop, the police judge and the City Council are all very unpopular with me for the time being and until I can make up my mind that at least each one was trying conscientiously to do his duty for the good of the greatest number. I hope you will believe me when I assure you that that last purpose is the motive actuating this Board and all our employees.

In the case just cited, I may want to discuss with the policeman as to whether he might not be mistaken as to the speed I was going. Our inspector must always be ready to talk with any of you as to whether or not you are violating a rule and as to how best and easiest for you to correct the violation.

I may want to discuss with the judge the question as to whether I did not have an excuse for going too fast or whether the law is unconstitutional. Our heads of departments, and Dr. Newell himself, must always be ready to discuss with any of you any facts as to the reasonableness of the application of the rule to your case.

I may want to go to the City Council to discuss with them the desirability of the law and whether there should not be some changes in it. The State Plant Board is always glad to have any of you write to us or meet with us and find out our reasons for making any rule that we promulgate and help us if you disagree with what we have done by giving us your reasons for thinking so.

We must many times make rules which might not be necessary if we had only our own local conditions to consider. We know on the other hand that if we do not make and enforce these rules that the Federal Department of Agriculture will place another embargo on the shipment of certain classes of our agricultural products. Or we are put on notice by one or more of our sister states that they will not allow shipment of certain products into those states. We know that not for our protection but for that of other states nursery stock, bulbs, other products and now potatoes must be certified as being free from pests of either insect or disease variety or they cannot be received in one state or another. Then we have similar rules as to shipment of many products of agriculture into Florida for the very definite protection of each of you engaged in that pursuit, having money invested in it or just being a citizen of this State for the welfare of all of us is very directly tied to your industry.

Since the establishment of this Board in 1915 through our internal quarantine work we have entirely eliminated, or practically so, several pests some of which were here at that time, some of which have come since then despite the best of our efforts to prevent. Our climate induces pests of many kinds, our nearest neighbors—both domestic and foreign—have many pests which could easily gain a foothold and do untold damage to us.

Even if we as sensible individuals were willing to follow the lead of the ostrich and put our heads in the ground and say, "There are no plant pests in Florida," we would be just as badly off for as shown the Federal Government or our sister states would say we believe you have and therefore you can't ship or sell your products.

That protection from pests is an economic necessity for survival of Agriculture is evidenced by the estimates of competent authorities that the yearly losses in this country from plant pests run from $1,500,000,000 to $2,000,000,000. Furthermore, the American farmer pays each year $37,000,000 for insecticides and other spray material. These figures for Florida alone are not available, but I feel sure would sum up to startling amounts and certainly justify the small sum of money provided for the expenses of the work under our Board.

Let me give you just a few facts regarding the details of our work. It is divided into five major divisions as follows:

Grove inspection
Nursery inspection
Quarantine (Transit) Inspection
Apiary inspection
Entomology

Then we are carrying out at the present time four special activities:

West Indian Fruit Fly Eradication
Black Fly Eradication
(both at Key West)
Pink Bollworm Eradication
Irish Potato Certification

We have a schedule at present calling for inspection of all citrus planting once in two years, a frequency very close to the danger line for the twenty-six and a half million trees in the state.

We inspected last year the 1819 nurseries an average of 4.3 times. Our quarantine forces during the fiscal year ending June 30, 1934, inspected 6,000 ships upon arrival from foreign ports and well over 1000 airplanes and during the quarter ending December 31, 1934, 527,000 parcels from foreign countries. Each ship, each airplane, each passenger and each parcel is a potential carrier of plant pests.

Since the establishment of our Department of

Entomology in 1915, it has handled and recorded close to 55,000 different kinds or species of insects.

I have run the risk of boring you with the few statistics to attempt to give you a clear picture of the scope of the work which is being done from one end of our state to the other by our force of only 65 men.

Our appropriation for the fiscal year 1933-34 was $194,000, of which by the exercise of the utmost economy because of the condition of the State's finances we only expended $182,000. In making this reduction, however, we have curtailed temporarily what we consider essential services. In our judgment it would be dangerous to the agricultural industry of the State to continue this curtailment any longer and have asked for a sum of $210,000 per year for the next biennium. The Budget Commission has recommended to the Legislature a budget of $194,000. The members of the Plant Board feel that it is essential to have the amount asked for and we trust that the Appropriation Committee of the Legislature will see fit to restore the appropriation to that figure.

In closing, let me repeat that the Board realizes its responsibility and is doing its conscientious best to protect the Agriculture of the State. We, however, realize we may make mistakes. We call for your wholehearted co-operation with us and urge you to give us an opportunity to explain by word of mouth to you our reasons for actions which we take before you condemn us too severely. We also urge you to give us the benefit of your knowledge and experience in carrying out the very complex duties devolving upon us. We invite you to meet with us at any of our monthly meetings and would be glad at any time to make special appointments for such meetings. Let me again thank you for your courtesies to me here today.

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Question: Mr. Chairman, I would like to ask a question. Supposing the Black Fly and the West Indian Fruit Fly should escape and get into our section, would there not be grave danger of our facing a federal quarantine that would prevent our shipping out of the State?

Answer: There is a grave danger of this. As you know, there has been an appropriation bill which provides an emergency fund of $50,000, which can be made available to meet any serious situation. I do not want to appear as an alarmist, but I might say that we are all convinced that the work is being adequately carried on down there and the elimination of these two pests will be fulfilled. We have no doubt of that fact or fear that they will get on the mainland. In fact, we have the full co-operation of Mr. Julius Stone and the FERA organization and they have made it a criminal offense to prevent the men from going into properties and doing the work on trees. We have not wanted to enforce the state law and have attempted to avoid carrying out our authority legally. We believe we have practically eliminated objectors, which we believe has eliminated any chance of trouble down there.

Question asked of Dr. Ruprecht, in regard to his paper of the morning: I fear from what I have heard that there are some erroneous conclusions drawn as to what Dr. Ruprecht had in mind this morning in regard to the use of rare elements in fertilizer.

Answer: (Dr. Ruprecht) I am sorry I was misunderstood by some this morning. What I wanted to say was that I did not encourage the use of these secondary elements by every Tom, Dick and Harry around the state. Of course, where the benefit of their use has been demonstrated, there is no objection. Of course all work in the use of these elements is in its infancy and what the real effect will be is not as yet known. The use of zinc sulphate has been shown to be very advantageous in many cases, while in other cases the zinc sulphate was used and the benefits found missing in the resulting crop. This needs thorough study. So little is known of the ultimate effect, and in many cases, the immediate effect, of some of these elements that it is extremely dangerous to use them unless you know that in the condition you are facing it is absolutely needed. Even then, it is better to use a separate application until the beneficial effects have been amply demonstrated. I have no quarrel with any one who uses these elements, but do not say that these elements can take the place of regular fertilizers. No one has demonstrated that this

can be done. It is undoubtedly true, that in the years to come, we will find them more used, but until their beneficial results have been demonstrated, I stick to my guns and say that you had better not use them promiscuously.

Superphosphates, and nitrates as they come from Chile, and also organics contain many of these elements in small amounts and they are undoubtedly beneficial and the common use of them has provided these elements. The reason that any need is just showing up now is that the use of the above materials is not as common as in the past.

In connection with borax on celery, we found that ten pounds per acre would eliminate cracked stem, but at the same time, using twenty to twenty-five pounds to the acre, we would have decided injury. Another thing, we do not know just what happens. We hope before many years to know definitely what the facts are.

## CITRUS GROWING IN INDIAN RIVER COUNTY

**Harry S. Jones, Vero Beach**

The exact date of the first citrus plantings in this county is not definitely known. It is a fact, however, that there were bearing orange trees at what is known as Barker's Bluff as early as 1883. This bluff is a relatively high point on the west bank of the Indian River and on the south bank of the Sebastian River, about fifteen miles north of here and near the present town of Roseland. At this point a Mr. Barker for whom the bluff was named ran an Indian trading post previous to 1883. He had undoubtedly planted some sweet orange seed and these became the first sweet orange trees in Indian River County.

Mr. Frank Forster made the first planting on the island, that is, on the east shore of the Indian River and about nine miles north of here, in 1883, and Mr. Michael, father of Mr. A. B. Michael of the American Fruit Growers, planted some groves at this same location in 1887. Nearly all of these early plantings on the island were killed by salt water in a severe tropical storm in the fall of 1893. A few trees, however, survived this salt water bath and were only slightly damaged by the freeze of 1894-5. The coldest temperature experienced on the island since 1883 was on December 30, 1894, when the temperature went down to 26 degrees.

The earliest plantings in the immediate vicinity of Vero Beach were made by Mr. Gifford, father of Charles Gifford, one of our present successful growers. These plantings were made in 1890 and were well within the present city limits, in fact only about three blocks from this building in which we are now assembled. Some of these trees are still living and still bearing. They were hurt some by the freeze of 1894-5 and in 1896 produced no fruit. That is the only year in forty-five years that these trees have missed bearing a crop. In the early nineties the West Grove and the Helseth groves were planted on the sand ridge four to five miles south of this city. About this same time, Mr. Eli Walker planted a grove in a high hammock about three miles west of the city.

Previous to the freeze of 1894-5, prices for oranges and grapefruit were not particularly high, one dollar per box on the tree being the usual price. After the freeze, however, prices advanced considerably and Mr. Gifford relates that many a box of grapefruit was sold on the tree for two dollars per box. This was before the day of standardized containers and each grower was quite at liberty to make boxes that suited his own ideas as to capacity. What with grapefruit bringing two dollars per box on the tree and boxes of a size to suit the grower, those were the good old days.

These early plantings which certainly did not exceed 100 acres were pretty generally located where there was good natural drainage into the Indian River. To the west of these naturally drained

locations lay several thousand acres of good land, but low and flat, with a high water table and no natural drainage.

It was long realized that before this land could be utilized and our back country developed, artificial drainage must be provided. Accordingly a drainage district was planned and a company known as the Indian River Farms Company, was organized by Mr. Herman J. Zeuch in 1912 to carry out the plans for draining this territory. Money and equipment was provided to drain 48,000 acres. A ditch was dug on the north, west and south sides of this entire area, with the spoil bank forming a dyke of sufficient height to keep out the surface water from the surrounding territory. A total of 480 miles of large and small canals was dug within the district.

Briefly the system of drainage is this: Three large canals are connected by lateral canals running east and west and one-half mile apart. Into these sub-laterals the private farm and grove ditches empty their excess water. This has given this entire area excellent drainage. The management and control of this drainage district is vested in a board of supervisors elected by the land owners of the district. This board has charge of the maintenance of these canals, laterals and sub-laterals and for this service the land owners pay approximately fifty cents per acre per year.

Following the completion of this drainage system in 1914 the business of producing grapefruit and oranges expanded rapidly until we now have some 8,800 acres devoted to the growing of citrus fruit. This acreage and the fruit produced therefrom enables this county to rank thirteenth among the thirty-five citrus producing counties in the state. Sixty-eight per cent. of our 8,800 acres are devoted to the growing of oranges and the balance to grapefruit and tangerines. Of the oranges produced, approximately ninety per cent. are divided about equally between Pineapple oranges and Valencias. The balance is made up of Parson Browns, Hamlins, Connors seedless, Jaffas, Temples, Kings and a few seedlings. At the present time the bearing grapefruit trees are divided about equally between Duncan and Marsh Seedless. In recent years the plantings of grapefruit trees have been almost entirely of Marsh Seedless. There is a noticeable tendency in recent plantings to plant more heavily to Hamlins and some growers have recently planted a few pink grapefruit.

Trees within the drainage district are all planted on beds or ridges. This bedding of the land is accomplished, of course, by plowing in such a way as to throw the furrows together forming a ridge. Two or three plowings are usually required to get this ridge to the proper elevation. Then mounds are built on top of this ridge where each individual tree is to be set. These mounds vary from three to four feet in diameter and are made six to twelve inches higher than the ridge, dependent upon how high the grower thinks it necessary to set his trees. For the next two or three years additional plowings are made, the dirt being thrown to the mounds so that the final result is a gradual slope from the crown roots of the tree to the water-furrows between the beds. These water-furrows serve a double purpose. Not only do they aid in carrying off the surface water from the grove, but they serve as distributing channels when irrigation is resorted to.

The width of the beds on which our trees are planted varies all the way from 20 to 40 feet dependent in the past upon what distance suited best the fancy of each individual grower. It is becoming quite the standard practice, now, however, to plant orange trees on 25-foot beds and 20 feet apart in the row, grapefruit trees on 30-foot beds and 25 feet apart in the row. These distances allow ample room between the rows for the use of all kinds of grove equipment, provide sufficient space for the trees to reach maturity without crowding and permit setting about 85 orange trees or 55 grapefruit trees to the acre.

In recent years the practice of planting trees on so-called double bed has become quite popular. These double beds have a water-furrow only every 50 feet where oranges are planted, and only every 60 feet in the case of grapefruit. It is the contention of those who favor the double bed that this method provides a greater area of surface soil for the feeder roots, that the double bed will not dry out as quickly as the single bed,

and that the middle where there is no water-furrow provides a much better roadway for the sprayer, for hauling fertilizer into the grove, and for hauling out fruit than is the case with the single bed where there is a water-furrow in every middle.

One of the most valuable assets from a grower's point of view, of which this section can boast, is its abundant supply of artesian water. This water is obtained by drilling to a depth of 500 to 600 feet. One four-inch well drilled to this depth, at a cost of about $450.00, if correctly located, will furnish sufficient water for irrigating a forty-acre grove. With such a well properly located and the water correctly distibuted, no tree in any grove need ever have a wilted leaf. This water is good for every purpose for which man could possibly use it. It is good for humans to drink. From the standpoint of being uncontaminated it is, of course, extremely pure. It is good for livestock and good for irrigating the grove. It is perfectly satisfactory to use with every kind of spray material used in a grove. There is one exception to this. There is one kind of spray material, a mecurial compound, in which the artesian water is not suitable, but we get around that by not using this material.

This water is alkaline in its reaction and contains a relatively high amount of minerals. These wells have sufficient pressure to operate a small generator which will furnish electricity for the farm house and farm buildings, and sufficient pressure to operate a stand pipe for filling the spray tank so that pumps or other filling devices are unnecessary. The most amazing thing about this artesian water is its apparently inexhaustible supply. In one recent summer we experienced a drought of about ninety days duration. During this time it is safe to assume that every well in the Indian River district (and there must be thousands of them) was wide open and yet none of them stopped flowing because of a lack of water. Toward the end of this period there was a slight decrease in the flow but the amount of water being obtained was still ample.

With such a supply of water as this, irrigating a grove is a relatively simple matter. At least each twenty-acre block of trees is surrounded by ditches which of course, aid in draining the grove. When it is desired to irrigate, the outlets to these ditches are closed and the ditches filled with water. From these ditches the water flows into all parts of the grove by means of the water furrows already described. Irrigating a grove is largely a matter of opening a four-inch valve. This is neither laborious nor expensive. There is no money tied up in pumps, engines, slip-pipe or other distributing media. Nor is there any equipment to rust and deteriorate. About the only equipment required is a good shovel and a darky with a strong back.

Strangers seeing our groves for the first time often ask why we do not disc and prevent the growth of grass and weeds in our groves. The answer is, we want the grass and weeds. Frequent mowing of this growth and permitting it to lie on the ground where it rapidly decays means that we are continually renewing the supply of humus in the soil. A soil well supplied with humus is always a well aerated soil. It is not nearly so apt to become water-logged at the time of excessive rains, nor does it dry out as rapidly in dry weather as does soil that is devoid of humus. Furthermore, this carpet of vegetation forms a protective blanket during hot weather for the feeder roots of the trees which are very close to the surface. The growing of the grass and weeds is an excellent method of removing during heavy rains, a large portion of the excess surface moisture.

It is often asserted by those unfamiliar with our methods that a great deal of our fertilizer goes to growing grass and weeds. That is true but so long as we mow frequently we are converting this fertilizer into a form most readily assimilated by the trees—decayed vegetation. I would call your attention also to the fact that there is very little leaching of the nitrogen in the decayed vegetation as compared to the heavy leaching of nitrogen when applied in the mineral form. To get the maximum results from our fertilizer and from our vegetation it is essential that we mow often enough to get the greatest amount of growth. Let me explain this by saying that after grass and weeds reach maturity no further growth takes place, whereas there is

immediate growth after each mowing. Then too there is very little value in vegetation that has been allowed to die standing up, but grass and weeds that are mowed while green and succulent are high in plant food.

There is one more advantage to mowing frequently. Green and growing grass will not support combustion, but grass and weeds that have been allowed to mature and die standing up are excellent fuel for a fire and will furnish sufficient heat to completely destroy a fruit tree. One method of attempting to keep fires out of groves is to keep a fireguard around the grove disced clean of all vegetation. It is claimed by some that this is of little value, except as a place to start a backfire, as in a high wind burning embers are carried over the fireguard and into the grove. But if the burning ember falls in green grass it will not last long. It is possible to find groves in this section that have been kept well mowed and in which there has been no damage from fire in the past ten years.

The question of keeping down to a minimum the damage from fire is in a fair way of being answered now, so far as this community is concerned. A fire protective association of grove owners has recently been formed, fire fighting equipment has been purchased and this equipment is available to any grove owner who has contributed to the cost of the apparatus.

Fertilizing, here as elsewhere, is done by about as many methods as there are growers and the surprising thing is that all of these methods work so well. If we knew exactly how to fertilize we might grow two oranges where only one grows now, but what would we do with the other orange? Fertilizing in this section differs from that of other sections probably in only two particulars; the low per cent. of ammonia in our mixtures and the small amount used. In many groves, grapefruit trees 15 to 20 years old receive in a year not more than 25 pounds of fertilizer containing only 2 to 3 per cent. ammonia. These trees bear well every year and almost never show any signs of nitrogen deficiency. One grove containing a 10-acre block of 825 11-year old Valencia trees has this year produced 4,703 field boxes of oranges. This is the fourth consecutive year that these trees have produced a good crop and yet they have never received more than 16 pounds of a 3-8-8 fertilizer per year. That is exactly what they were given this past year and they have had no fertilizer since November. Yet after carrying this heavy load they show no signs of insufficient feeding.

There are four samples of soil on display here which are representative of our best citrus land. No. 1 is a sample of our heavy hammock soil having a dark, rich top soil containing a large amount of decayed vegetation. Underneath this is a layer of marl and clay and still further down is a deposit of shell and marl. The lime in this marl is in the carbonate form and since these particles are finely divided this line is quite readily available. The shells are also carbonate of lime, but since these particles are coarse this is only slowly available. This subsoil, with its marl, clay and shell is the chief characteristic of the Indian River District and is the basis for setting legal and geographical limits to this section bearing the Indian River name. No. 2 sample shows a top soil of fine gray sand with a layer of yellow sand underneath. Further down at a depth of about 3 feet is a deposit of blue clay. No. 3 is from the Island east of Wabasso where Mr. Michael grows such fine grapefruit. No. 4 is a sample of the soil in the Oslo Hammock where Mr. Sexton grows his price winning oranges and grapefruit.

There are places in this section where this marl subsoil is so close to the surface that it becomes a top soil. Trees growing or trying to grow in these spots get into a lot of trouble. They french badly, dead wood develops rapidly, and a condition of almost permanent dormancy develops. There is very little new growth and almost no bloom. Happily, however, a solution to this problem has been found. The work of the Experiment Station with Manganese in the tomato growing section of Dade County where the soil is of a calcareous nature gave us some good ideas. At first the results of using Manganese in these marl areas were rather discouraging. Experiments were then tried using much

larger amounts than formerly and this gave the answer we sought, when applied to grapefruit trees. Fifteen pounds of Manganese Sulphate applied in 3 applications of 5 pounds each over a period of one year will actually make a grapefruit tree go to work. In 18 months after the first application the frenching will almost entirely disappear. Deadwood will cease showing up, the tree will put on a rich green color and a heavy bloom. With orange trees growing on these outcroppings of marl, the Manganese produced no outstanding results. However, Dr. Camp's work with Zinc Sulphate on Tung Oil trees and his experiment of spraying badly frenched orange trees with Zinc Sulphate and Lime Sulphur gave us another idea. After listening to Dr. Camp's discussion of the use of Zinc Sulphate at the meeting of this society last year in Orlando, we came home and sprayed a group of badly frenched orange trees which had persistently refused to respond to Manganese, or Blue Stone or Copperas. These trees were sprayed with 5 pounds of Zinc Sulphate and one gallon of Lime Sulphur to each 50 gallons of water. We repeated this spray last January and today these trees show almost no signs of frenching, they have taken on a good rich green color, and this spring put out a heavy bloom.

You will not want me to stop, I am sure, until I have told you something of the effects of last December's cold spell. A state wide survey of the cold damage made by the Florida Emergency Relief Administration, co-operating with the Citrus Control Committee, showed that this county suffered no loss of growth to its bearing trees, that non-bearing trees suffered a 5% loss of leaves and growth and that the fruit damage was: Tangerines 20%, Oranges 3% and Grapefruit 0%.

## THE EFFECT OF HEATED WATER AND DYE SOLUTIONS, BRUISING AND FREEZING ON FLAVOR AND STORAGE QUALITY OF ORANGES

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About the middle of last December Florida Pineapple oranges showing a peculiar type of pitting or rind injury began to arrive on northern markets. In some cases the fruit looked as though it had been seared with a hot iron over a strip of varying width—sometimes encircling the entire fruit. The affected surface usually was characterized by collapsed oil cells, a darker color, a more leathery texture and by being sunken and having the general shrivelled appearance of "ageing." In other cases the fruit was severely marked with a type of pitting not previously observed and not at all characteristic of the pitting which develops in storage. Many of the pits were elongated and of irregular shape, appearing as though the orange had been bruised by dropping onto a small broken branch, a nail or some similar object. In some cases the injury gave the oranges something of the appearance of being "creased." Some of the same characteristic symptoms have since been observed on Valencia and other varieties of oranges after being picked and packed late in their season.

The development of these characteristic injuries on Pineapple oranges was practically coincident with the rather widespread adoption of the use of chemical dyes to color the fruit in Florida, and also coincident with the arrival of fruit on northern markets which had been subjected to the severe freezing weather of December 11 and 12 when temperatures as low as 19° F. were reported from different parts of the Florida citrus producing area. The later varieties upon which the same effects have been noted were similarly subjected to the same freezing temper-

atures and the use of dyes for adding color to the rind.

The prevalence of these injuries gave rise to many complaints in the trade and the rejection of some consignments. It became important therefore to determine the cause of the injuries and the factors which initiate them or influence their development. Studies were undertaken immediately, therefore, on the possible influence of the dyes, of the heat used therewith, the effects of bruising and freezing, and of combinations of these various factors. The study of the effects of the dye treatments was conducted in various packing houses in Florida while that dealing with the other factors was conducted at the laboratories of the Bureau of Plant Industry at Arlington Farm, Va. These latter studies as necessary preliminaries to the work in the packing houses will be described first.

Upon receipt of telegraphic advice on December 13 of the severe freezing damage which occurred over much of the State of Florida on the two previous nights, a supply of non-dyed Pineapple oranges and tangerines was purchased on the Washington market and kept at a temperature of 40° F. to insure having non-frost-injured fruit available for experimental use.

### Experiment 1

The object of the first experiment was to determine the possible effect of subjecting the fruit to a hot water treatment for varying lengths of time, corresponding somewhat to the extremes of temperature and of time of subjection thereto in the process of dyeing the fruit in Florida. The treatment given was generally similar to the dye process as used in Florida except for the omission of any dye.

The fruit was treated December 27, 1934, for periods of 3, 5, 10 and 15 minutes each in a water bath held constantly at 100° 105°, 110°, 115° 118°, 120° and 125° F.

After treatment, all the samples were stored at 32° F. and inspected daily for 12 days. Some individual oranges developed slight pitting but no single treatment differed significantly from the check or untreated lots.

### Experiment 2.

As no significant differences were observed in Experiment 1, it appeared that if the injuries were caused by heat treatments the temperatures used were doubtless too low and it would be desirable to conduct another experiment embodying use of a higher range of temperatures, and possibly to change the storage conditions after treatment. Experimental lots of Pineapple oranges were therefore exposed for 3 and 10 minutes each in a water bath at temperatures of 125°, 130°, 140° 145° and 150° F. After the treatment, a part of the fruit in each lot was stored at 40°, the remaining fruit was stored at room temperature (about 75° F.).

The oranges were observed daily for one week after treatment. Pitting was noted in all of the lots but again there was no significant difference between any of them, including the check. More pitting developed when the fruit was held at room temperature than in the lots stored at 40° F. The outstanding result of these treatments was the effect produced on the appearance of the fruit and the quality of the juice of those lots which had been submerged in water at temperature of 135° or above. The juice from the fruit of these lots was poor in quality and off flavor. The orange had a cooked appearance with sunken oil cells, which made the orange very rough. The sunken rind tissue darkened as the time of holding increased.

Chemical tests on the acidity of the juice of treated lots showed that the per cent. of acid decreased as the temperature of the water bath was increased, as well as by holding the fruit at the warmer storage temperature. (See Table 1.)

### Experiment 3

Experiment 3 comprised a third series of heat treatments similar to those given in Experiment 2. In Experiment 3, however, bruising was made the varying factor. Oranges were bruised before and after submersion in the hot water and the fruit was stored thereafter at two different temperatures, 40° F. and room temperature of about 75°, as in Experiment 2. It was observed daily for 5 days but no significant differences in pitting

TABLE I

CHANGES IN ACIDITY OF THE JUICE OF PINEAPPLE ORANGES BY HOT WATER TREATMENT AND STORAGE TEMPERATURE

PINEAPPLE ORANGES AFTER A HOLDING TEST OF 7 DAYS

| Time exposed in hot water | Temperature of water treatment | Storage temperature | Acid |
|---|---|---|---|
| Minutes | °F. | °F. | Percent. |
| None | None | 40 | 1.69 |
| None | None | 75 | 1.45 |
| 10 | 125 | 40 | 1.67 |
| 10 | 125 | 75 | 1.41 |
| 10 | 135 | 40 | 1.61 |
| 10 | 135 | 75 | 1.34 |
| 10 | 145 | 40 | 1.59 |
| 10 | 145 | 75 | 1.26 |

were manifested at any time except that the oranges bruised after the heat treatment showed the greatest amount of injury, which, however, was not of the types being investigated.

### Experiment 4

The factor of freezing injury remained to be investigated. Accordingly, on January 20, 1935, a large lot of Pineapple oranges was placed in one of the freezing rooms in the cold storage laboratory. The temperature of this room was 19° F. which was similar to the minimum temperature reported in Florida, December 11 and 12, 1934. The oranges were held for 12 hours at 19° after which the frozen fruit was transferred to 50° for 2 days and then to 75° for 1 day to make sure that thawing was complete. It was then divided into smaller lots and given various heat treatments. These heat treatments consisted in submerging the oranges for 3 minutes and 10 minutes in a water bath controlled at 90°, 100°, 118°, 125°, 130° and 135°. It was observed that while the treatment at 135° was being given most of the oranges developed pits before removal from the water bath. Careful inspections made on the other lots of the series immediately after treatment showed that about 80 per cent. of the fruit had also developed pits.

All the fruit in this experiment was held at room temperature after treatment and was inspected daily. Pits increased in number and size as the holding time increased. These pits were similar in tpye to the pitted oranges from Florida which had caused this investigation to be undertaken. While a few pits developed on the check fruit these differed from those produced by the heat treatment both in the number of pits and the area affected, and doubtless were caused directly by the freezing to which this fruit had been subjected, pitting of this kind being known to result from freezing. The heat treatment following the freezing, however, brought out the pits in far greater numbers and severity. This experiment was duplicated with practically identical results, except that in the second trial the effects on the rind tissue and the development of pits were observed during the treatment even at the lower temperatures.

The pits produced in Experiment 4 (that is, by submerging Pineapple oranges that had been frozen previously in a water bath heated to from 90° to 135° F.) resemble in general character, form and size the pits observed on dyed fruit after shipment to northern markets. The pits produced in Experiment 4 were scattered promiscuously over the surface of the orange, usually had "V" shaped sloping walls and the larger ones, to some extent, resembled creasing. They differed from ordinary storage pits which usually occur at the stem end of the fruit and have "U" shaped walls. In order to determine how and to what extent the quality and condition of oranges as they reach the consumer are affected by the use of dyes, much more experimental work is required, studying such factors as different concentrations, different temperatures of the dye solution and varying lengths of exposure thereto. The preliminary studies reported herewith must be regarded as indicative only and not in any sense conclusive. However since they have already resulted in important modifications in practice to eliminate some of the injurious effects produced it seems desirable to present a brief

summary of these experiments for purposes of record.

On January 31, 1934, a supply of tree run Pineapple and Valencia oranges was obtained from a grove near Vero, Fla. This fruit had escaped the December freeze so that the factor of freezing injury found to be so important in intensifying the pitting effects in the earlier experiments was eliminated in the packing house studies. The fruit for the experiments was trucked to the Orlando laboratory and on the following day two box-lots of each variety were given each of the three different dye treatments then in commercial use in the State. For this purpose the fruit was taken to three different packing houses at other points and was handled through the regular processes the same as the commercial crop. After receiving the dye treatments the fruit was returned to the Orlando laboratory and was stored at 50° F. for 3 weeks. One-half of the fruit was wrapped in the usual way and the other half was not wrapped. All were regularly packed in four-fifths bushel boxes. Comparable check lots of each variety, comprising non-treated oranges just as they came from the trees, were held under the same conditions for comparison.

At the time of storage the solids: acid ration was determined on the juice from a composite sample of 15 oranges. At the end of the storage test all lots were inspected and the data recorded in Table 2 was obtained. This table shows the changes which occurred during the interval in acid, total solids, weight and flavor as well as the development of pitting, creasing and decay. The results on pitting are also shown graphically in Figure 1.

RESULTS WITH VALENCIA ORANGES

*Changes in Total Soluble Solids and Acid:*

It will be noted in Table 2 that at the time of storage Valencia oranges had an acid content of 1.63 per cent., total soluble solids content of 10.85 per cent., and a soluble solids acid ration of 6.565. These oranges therefore were immature and could not be shipped under the Florida legal standard, which reads* "That within the purpose and meaning of this Act, oranges shall be deemed to be mature only when the ratio of the total soluble solids of the juice thereof to the anhydrous citric acid is not less than eight to one (8 to 1) and when the total soluble solids of the juice thereof is not less than 7½ per cent." After three weeks' storage at 50° F., a decrease in per cent. acid was noted in the fruit from all the dye treatments, as well as the check. At the same time the total soluble solids were increased from 10.85 per cent. to a range from 11.37 to 11.87 per cent. This change, involving a loss of acid and an increase in total soluble solids, affected the ratio so that most of the storage lots would have passed the State requirements. The exception was those lots which received dye treatment C, which had a ratio of 7.34 and 7.79.

*Development of Pitting:*

Considerable variation was noted as to the development of pitting in storage as affected by the various dye processes. In all cases, however, the dyed lots showed an increased amount of pitting over the check or untreated lots (Fig. 1). The check lots showed about 18 per cent. of fruit pitted, that which received treatment C 22 per cent., that which received treatment B 35 per cent., and that which received treatment A 60 per cent. In addition to these percentages which were based on the total number of pits, it is important to consider the size of the pits or the total area affected. With the exception of lots from treatment A all the pits were small and rather inconspicuous whereas the pits which developed from this treatment were very large (one-fourth inch in diameter or larger) and very conspicuous.

This wide range in the amount of pitting, from 18 to 60 per cent., suggests varying degrees of toxicity in the various dyes, since the processes of application were generally similar. These processes differed principally in the character, concentration and temperature of the dye solution and the length of exposure thereto. The lot which developed the least pitting was that which was exposed the shortest time at the lowest temperature, which is further evidence of the toxicity

*Section 4. Citrus Fruit Law, The State of Florida, Department of Agriculture. August 1, 1931.

## TABLE II

THE EFFECT OF VARIOUS METHODS OF STAINING FLORIDA ORANGES ON QUALITY AND CONDITION OF THE FRUIT STORED AT 50° F. FOR THREE WEEKS

### VALENCIA ORANGES

| Packing House | Pack | At Picking Time | | | Condition of Fruit after Storage at 50° F. for 3 Weeks | | | | | | | | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Percent. | | | | | | | | | | | |
| | | | | | | | | Pitting | | | Creasing | | | | | |
| | | % Acid | % Sol. Solids | S/A Ratio | Acid | Sol. Solids | S/A Ratio | Slight | Med. | Bad | Slight | Bad | Decay | Sound | Loss in Wt. | |
| Check | Not Wrapped | 1.63 | 10.85 | 6.56 | 1.41 | 11.87 | 8.39 | 12.8 | 0.0 | 0.0 | 0.0 | 0.0 | 2.1 | 85.1 | 2.00 | Slight wilting Flavor fair to good. |
| Check | Wrapped | 1.63 | 10.85 | 6.56 | 1.35 | 11.72 | 8.69 | 22.7 | 2.1 | 0.0 | 0.0 | 0.0 | 0.0 | 75.3 | 1.11 | |
| Treatment A | Not Wrapped | 1.63 | 10.85 | 6.56 | 1.40 | 11.72 | 8.39 | 43.7 | 3.1 | 2.1 | 0.0 | 0.0 | 0.0 | 51.0 | 1.19 | Pits large—flavor poor—stale and off flavor. |
| Do A | Wrapped | 1.63 | 10.85 | 6.56 | 1.38 | 11.74 | 8.49 | 54.4 | 4.4 | 1.1 | 0.0 | 0.0 | 1.1 | 38.9 | 1.12 | |
| Treatment B | Not Wrapped | 1.63 | 10.85 | 6.56 | 1.43 | 11.62 | 8.10 | 26.9 | 1.1 | 0.0 | 0.0 | 0.0 | 0.0 | 72.0 | 2.33 | Practically no wilting—pits small—flavor fair. |
| Do B | Wrapped | 1.63 | 10.85 | 6.56 | 1.36 | 11.37 | 8.36 | 40.4 | 1.1 | 0.0 | 1.1 | 0.0 | 0.0 | 57.4 | 1.10 | |
| Treatment C | Not Wrapped | 1.63 | 10.85 | 6.56 | 1.46 | 11.37 | 7.79 | 27.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 72.9 | 1.71 | Practically no wilting. Pits very small. Flavor fair. |
| Do C | Wrapped | 1.63 | 10.85 | 6.56 | 1.55 | 11.37 | 7.34 | 18.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 81.2 | 0.57 | |

### PINEAPPLE ORANGES

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Check | Not Wrapped | 1.09 | 13.19 | 12.15 | 1.04 | 13.17 | 12.71 | 58.8 | 3.1 | 1.0 | 5.1 | 0.0 | 0.0 | 32.0 | 1.70 | Slight wilting. Pits small. Flavor fair to good. |
| Check | Wrapped | 1.09 | 13.19 | 12.15 | 0.98 | 11.73 | 11.59 | 54.2 | 9.4 | 1.0 | 0.0 | 0.0 | 0.0 | 35.4 | 1.70 | |
| Treatment A | Not Wrapped | 1.09 | 13.19 | 12.15 | 1.01 | 13.03 | 12.85 | 58.8 | 20.6 | 7.2 | 1.0 | 0.0 | 3.1 | 9.3 | 2.05 | Slt. wilting, pits large. Flavor very poor, off flavor. |
| Do A | Wrapped | 1.09 | 13.19 | 12.15 | 0.98 | 12.53 | 12.81 | 67.4 | 12.6 | 7.4 | 0.0 | 0.0 | 3.2 | 9.5 | 1.72 | |
| Treatment B | Not Wrapped | 1.09 | 13.19 | 12.15 | 1.01 | 13.03 | 12.90 | 69.4 | 13.0 | 1.8 | 9.3 | 0.0 | 0.0 | 6.5 | 2.91 | Slight wilting. Pits small and numerous Flavor fair. |
| Do B | Wrapped | 1.09 | 13.19 | 12.15 | 1.00 | 12.98 | 13.03 | 55.0 | 29.0 | 8.0 | 7.0 | 0.0 | 0.0 | 1.0 | 2.30 | |
| Treatment C | Not Wrapped | 1.09 | 13.19 | 12.15 | 0.99 | 12.82 | 12.90 | 69.8 | 4.2 | 0.0 | 1.0 | 1.0 | 0.0 | 25.0 | 1.80 | Very slt. wilting, pits small, and numerous. Flavor fair. |
| Do C | Wrapped | 1.09 | 13.19 | 12.15 | 0.97 | 13.17 | 13.59 | 67.7 | 5.2 | 0.0 | 0.0 | 0.0 | 1.0 | 27.1 | 1.71 | |

of the dye or its excessive concentration as used in this treatment.

*Quality Based on the Flavor of the Juice:*

In sampling juice to determine quality, judgment was based on the opinions of several people who were called into the laboratory and who were unfamiliar with the different treatments. Without exception all voted the check or untreated fruit as having the best quality juice; also without exception all agreed that the fruit which received treatment A was the poorest in quality. The fruit which received the other two treatments was rated as intermediate or fair in quality.

RESULTS WITH PINEAPPLE ORANGES

*Changes in Total Soluble Solids and Acid:*

At the time of storage the Pineapple oranges were well past their prime and had an acid content of 1.09 per cent., total soluble solids content of 13.19 per cent, and a ratio of total soluble solids to acid of 12.15. After storage at 50° F. for three weeks, the per cent. acid had decreased from 1.09 to a range of from 1.036 to 0.970. Total soluble solids changed from 13.19 per cent. at time of harvest to a range of from 13.17 to 11.73 per cent. after storage. This decrease of acid and in total soluble solids changed the ratio from 12.15 to a range of from 11.59 to 13.59. The difference in the way this change in the ration of soluble solids to acid was brought about with the Pineapple oranges as compared with the Valencia may possibly be explained by the fact that immature oranges respond in a different way than oranges which have passed their prime.

*Development of Pitting:*

It is commonly known that the rind of Pineapple oranges is very tender and that this variety is very susceptible to pitting. In fact, with this variety pitted fruit may be frequently observed still attached to the tree before picking. This is particularly true of fruit left on the tree until very late in the season.

In these storage tests quite a high percentage of pitting was noted immediately after the dye treatments had been given, and an attempt was made to grade out all pitted fruit at this time. Had this pitted fruit been included in the storage lots the final record on severe pitting would undoubtedly have shown much more.

It will be noted that more pitting was found on Pineapple oranges than on the Valencias and that higher percentages of pitting were found on the dyed fruit than on the checks although even this fruit pitted severely in the Pineapple variety. Pineapple oranges which received treatment B had the highest per cent. of pitting, averaging about 88 per cent., while that which received treatment A had 87 per cent., and that which received treatment C 73 per cent. The pits in general were small and rather inconspicuous except on the fruit which received treatment A which developed large and very conspicuous pits, the same as in the case of the Valencias. Pitting of this character detracts very decidedly from the market value of the fruit.

*Quality Based on the Flavor of the Juice:*

The same method used for evaluating the quality of Valencia oranges was used for Pineapple oranges with practically identical results. The juice from the check oranges was rated best although the flavor showed some staleness or deterioration in quality. Fruit which received treatment A was quite undesirable, stale and off flavor, while juice from the fruit which received the other two dye treatments was rated as fair.

*Loss in Weight of Valencia and Pineapple Oranges Held in Storage Three Weeks at 50° F.:*

The storage lots were weighed at the beginning and end of the experiment to ascertain the loss of weight. This was found to vary from 0.57 per cent. to 2.33 per cent., and in every instance but one the unwrapped fruit showed the greater loss in weight. In the one exception the per cent. loss in weight was the same for both the wrapped and non-wrapped fruit.

NOTES ON DYES AND METHOD OF APPLICATION

*Treatment A.*

Dye—Aqueous solution of a proprietary non-certified food color.

Temperature of dye—125° F.

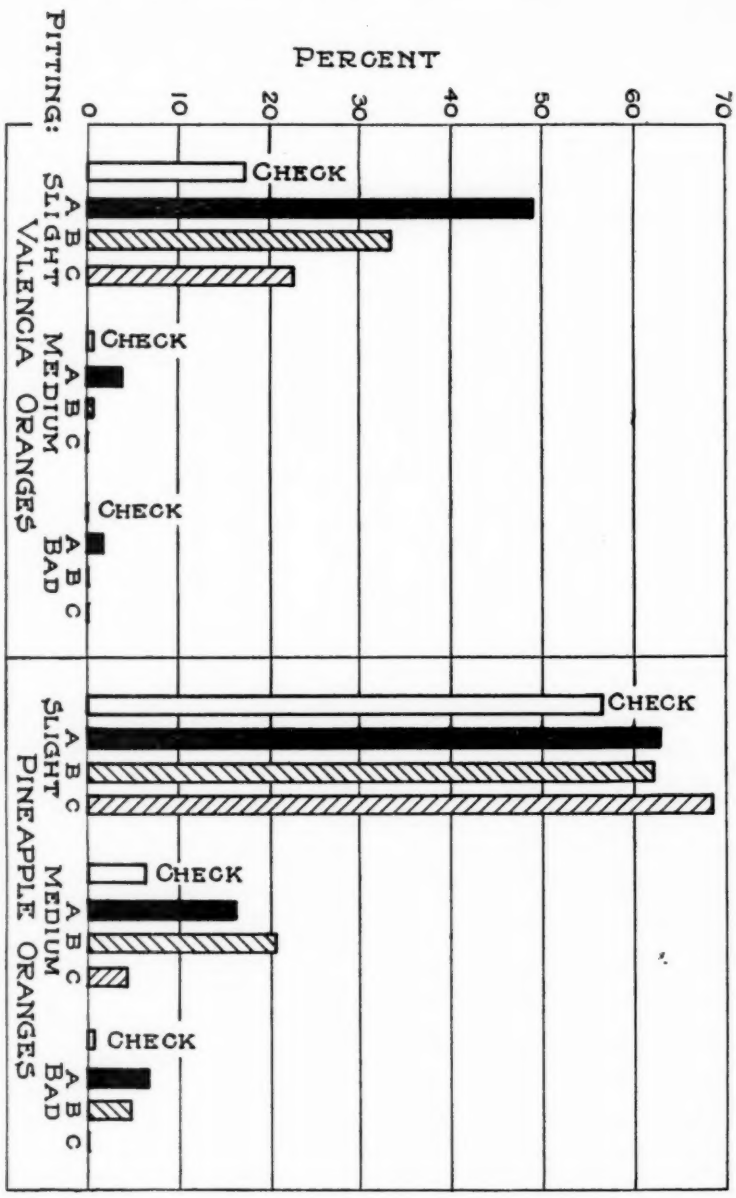


FIG. 1 THE EFFECT OF VARIOUS DYE PROCESSES ON THE DEVELOPMENT OF PITTING OF VALENCIA AND PINEAPPLE ORANGES AFTER 3 WEEKS STORAGE AT 50°F.

Length of exposure—4½ minutes.
Prior to dyeing oranges were washed in solution of borax, soda ash, and Zelnor's No. 10 with Wyandot detergent added.
Wax treatment—Food Machinery cold wax.

*Treatment B.*
Dye—Aqueous solution of a proprietary non-certified food color.
Temperature of dye—125° F.
Length of exposure—7½ minutes.
Wax treatment—"Hales water wax emulsion."

*Treatment C.*
Dye—Aqueous solution of certified food color dye (yellow OB and yellow AB).
Temperature of dye—114° F.
Length of exposure—4½ minutes.
Prior to staining oranges were washed in tank with soda ash solution at 88° F.
Wax treatment—none.

## PROGRESS IN ZINC SULPHATE STUDIES

**A. F. Camp, Horticulturist, and Walter Reuther, Laboratory Assistant**
**Agricultural Experiment Station, Gainesville**

It is not our intention to give a detailed report on the zinc studies at this time. what remarks are made will be primarily an introduction to a field trip to our experimental plots. This trip will follow this session and we hope that those interested will be able to go.

Before entering into a discussion of the work we wish to stress one point which was made last year, namely that zinc salts are useful in the correction of frenching or mottle leaf of citrus, but so far have not been found valuable in the treatment of other troubles of citrus. The zinc sulphate is recommended for trial in cases of true frenching but at this stage is not recommended for so-called bronzing or copper-leaf and other troubles. This warning has been made necessary by the great interest shown in the use of zinc salts with the result that they have been assigned a great many virtues which they do not, in reality, possess. This is to be expected when any new remedy is made available, but at the same time the grower should take care to inform himself concerning the actual results of research work and to utilize the treatment only as recommended or else to apply it in only a limited way for experimental purposes. Zinc is distinctly not a shotgun remedy and should be used only on the basis of the actual research work to date.

### TIME OF APPLICATION

In the experiments to determine the best time of application we have found this related to the condition of the tree. Sprays put on just before a flush bring a strong response with the appearance of the flush, whereas sprays put on after the fall flush do not show very satisfactory results until the following spring. In general it may be said that the best results were obtained from applications from February 1st to July 1st, and less satisfactory results during the latter half of the year. This was probably accentuated last year by the very dry weather in the central part of the state so that there was practically no fall flush in the groves used in that area. At Vero Beach, however, August sprays showed a definite response on the fall flush.

### AMOUNT AND CHARACTER OF APPLICATIONS

Soil applications continue to give unsatisfactory results in the citrus belt. Applications of 5 to 15 pounds per tree on badly frenched trees brought a slow response in most cases. The response, however, could not be compared with that obtained from one spray applied in the spring. Smaller soil applications have not given good results and there are some indications that larger applications may damage the trees. Spraying is

still the only recommended method of application for citrus.

A considerable amount of experimenting was done last summer in an effort to determine the concentration of zinc necessary to give results in sprays. The results of much of this work were unsatisfactory due to the dry weather and the December freeze. As a result of the latter a number of plots had to be abandoned before the work was complete. Other experiments, however, are now under way and we hope by next year to indicate definitely the contentration necessary to produce results with one or more sprays, and also to answer the question of frequency of applications. So far as the few uninjured (by cold) plots were concerned it appeared that one spraying per year was about as good as two or more.

A considerable amount of work is being done on the form of zinc in the spray. While the zinc-lime spray was used in most of the early experiments much work is being done this year with zinc sulphate in lime sulphur, Bordeaux mixture and oil emulsions and also with some commercial sprays made up by allowing zinc salts to react with lime, and then drying the precipitate. The latter sprays are used in the control of bacterial spot of peaches and are comparatively simple to use. The whole problem of the type of spray is tied up with problems of insect and disease control. Does the addition of zinc sulphate to lime sulphur reduce its value as an insecticide, does zinc-lime kill friendly fungi and consequently bring on scale infestations, does zinc help in the control of scab and melanose? The assistance of the Pathology and Entomology Departments has been solicited for this work and we believe they will be able to check all plots this year and help to answer these perplexing questions which have a very considerable bearing on the recommendations to be made. This work is all in progress and if things go well this year detailed reports should be forthcoming next year that will clear up many of these points.

For the present the following spray is recommended for use on frenching:

5 lbs. 89% zinc sulphate.
2½ lbs. high grade hydrated lime.
50 or 100 gallons of water (100 gallons for light cases of frenching).

After considerable experience last year the following suggestions are given for making the above spray.

1. If the zinc sulphate is lumpy screen dry and pulverize all lumps.
2. Fill sprayer one-half to two-thirds full of water.
3. Start agitator and add zinc sulphate very slowly—*do not* use the screen.
4. Screen in lime and spreader with water.
5. Use the spray immediately.

For a zinc-lime sulphur spray make up a 5-2½-100 zinc-lime spray as above recommended and add lime-sulphur solution *last*. The use of zinc sulphate in lime sulphur without the addition of lime is not recommended at present as it throws down too much sulphur and may affect the insect kill.

For Bordeaux with zinc sulphate added, we have had success with a spray made up as follows:

2 lbs. copper sulphate
4 lbs. hydrated lime
2 lbs. zinc sulphate.

Make up as a regular Bordeaux using the copper sulphate and all of the lime and then add the zinc sulphate slowly with the agitator running. You will note that sufficient lime is added to satisfy both the copper sulphate and the zinc sulphate. The fungicidal value of this remains to be determined and too much dependence should not be put on it for the control of melanose.

Considerable work is in progress on the effect of zinc sprays on the fruit. This work covers too short a period to be of authoritative value, but some trends are of considerable interest. The fruit on badly frenched trees is usually small, hard in texture, low in juice and very low in acid. Not infrequently it is badly ammoniated and when this is the case the amount of nitrogen in the pulp is abnormally high. Analyses of fruit from trees sprayed last summer showed that the use of zinc, even after the fruit was set, increased the acid and juice content material and while it did not eliminate the symptoms of ammoniation that were already present, it did not reduce the amount of

nitrogen in the pulp. While such fruit was not exactly normal in composition the changes were all in that direction. Much information along this line will be accumulated this year on crops set the year following spraying. The effect of zinc sprays on maturity and color is particularly important and is being intensively studied.

In the trip to the experimental plots this afternoon we wish to call attention to several points. The layout is not easy to look over as the area in which frenching was severe was very irregular, and consequently treatments do not show up as well as they do in other groves which were entirely frenched. A central point has been selected where effects of sprays and soil treatment can be seen to best advantage and the trees properly labelled. We wish to call attention to the fact that leaves which were frenched, when the spray was put on, have turned green but have not grown appreciably in size, that the new growth is both green and normal in size, that soil treatment gave fair results; also note that one spraying was apparently as effective as two sprayings. Other results will be self-explanatory.

## CITRUS FRUITS IN NUTRITION

**Dr. Ouida Davis Abbott, Gainesville**

Over the serving counter in a Dutch grill at the University of Pennsylvania there is this inscription in Pennsylvania Dutch, "Sak mir was du esscht und Ich sak dir was du besscht." Which in Pennsylvania Dutch is the equivalent for the old maxim, "Tell me what you eat and I will tell you what you are."

I think it might be possible to go even further and say, "Tell me what you eat and I will tell you what you do, whether you are a man or woman, girl or boy, and how old you are. A recent writer has divided the human life into eleven gastronomic ages which are as follows: 1. milk; 2, milk and bread; 3, milk, bread, spinach and egg; 4, oatmeal, butter, pop corn, and all day suckers; 5, ice cream soda and hot dogs; 6, minute steaks, French fried potatoes, coffee, and apple pie; 7, bouillon, roast duck, escalloped potatoes, French rolls, broccoli, fruit salad, divinity fudge, demi tasse; 8, pate de foies gras, potatoes parisienne, egg plant a la opera, mince pie, Rocheforte cheese, coffee; 9, soft boiled eggs, toast, milk; 10, crackers and milk;
11, milk.

Thus life comes to a close as it started—on milk. What has happened during the years? What have we done to our digestive tracts? Alas in many cases we don't know. A study of the diets of Americans made at the beginning of the World War shows that Americans are misfed rather than underfed. At the present there are indications that America is becoming diet conscious. What has been responsible for this?

One of the first reasons is that during the war when the conservation and substitution of food was necessary it was found that diets adequate in calories and protein, were still not adequate in food elements necessary for health and well-being. This opened up a new line of investigation—vitamin research. The discovery of the qualitative differences in diet led to the study of deficiency diseases and much light was thrown on certain diseases which up to that time had been wrapped in obscurity. Beri beri, polyneuritis, scurvy, xerophthalmia, rickets, were all found to be preventable and curable by diet. This was a great step forward and led to the study of other diseases whose etiology is unknown, such as peptic ulcer, diabetis, neuphritis, gall stones, hyperacidity, and others which respond more or less to diet.

Furthermore, the depression has made it necessary to feed large groups of people and it has been recognized that well fed people are content, that anarchy and revolution do not flourish among people that are well nourished. The best way to

cure a revolutionist is to fatten him. The various agencies have spread sound information on essentials of diet which has resulted in economic use of the family's money for food. The public is learning to buy food stuffs that have substantial values rather than those which appeal to the eye.

With all the attention that has been focused on food is it any wonder that quacks, food faddists, and unethical advertising have been able to sell to the ill and more credulous part of the population. Unfortunately so little is known of the actual value of foods that the public is still at the mercy of the charlatan.

Food advertising has value to the food industry so long as the public has faith in its integrity. Raymond Hertwig, Secretary of the Committee on Foods of the American Medical Association, writes this: "Does food advertising win your confidence when Hawaiian Pineapple Association claims that canned Hawaiian pineapple helps you digest other foods and speeds digestion particularly of protein of beans. Is your faith maintained by advertising claiming that "yeast has a greater effect on the intestines than any known food," advertising that presents pictures of doctors of far away countries with their professional testimony that the best way to prevent and correct constipation is to eat fresh yeast; when Florida orange advertising bursts forth with flaming claims that oranges prevent colds, prevent and cure influenza, prevent dyspepsia and peptic ulcers; that oranges keep away rheumatic fevers and pains. According to Mr. Hertwig food advertising spells ruin for itself and its sponsors of the industry unless it displays that integrity and true public service that will establish confidence and win faith in itself.

As with all other classes of foods citrus fruits must find a market and marketing depends upon demand and demand depends to a certain extent upon advertising. If we are to advertise citrus fruits what can we say that is true and at the same time will increase their use? There are so many reasons why we should use citrus fruits that it seems to me to be unnecessary to distort facts and make claims that cannot be upheld. These are some of the reasons that I use in urging the use of citrus and other fruits in nutrition:

Because of color, aroma and taste fruits appeal to the aesthetic nature. One could write a poem about an orange or an apple. Imagine going into rapture over a carrot or a parsnip. It is only of late that the nutritive value of fruits has been appreciated.

Citrus fruits, or most all fruits for that matter, because of the peculiar blending of acids and acid salts with sugar and aromatic substances are refreshing and appetizing.

It is commonly conceded that most fruits are laxative, especially if the entire fruit is eaten. The constituents contributing to this are the high percentage of water, salts in solution, mucilages, pectins and gums. In the skin or peels of certain fruits there are astringent substances such as tannins and related compounds which may have an opposite effect. In that case the fruit should be cooked.

Considerable bulk is necessary in the diet. If all the food eaten were digested and absorbed, elimination from the intestines would be retarded and cell wastes would accumulate. For this reason bulky food such as orange and grapefruit pulp are important because they contain relatively large amounts of cellulose and mucilages that stimulate the action of the intestines.

Fruits tend to prevent or correct excessive intestinal putrefaction. When meat forms a large part of the diet of people of sedentary habits, excessive intestinal putrefaction often occurs. Fresh fruit tends to prevent this by increasing the movement of the intestines and by furnishing a medium less favorable for the growth of bacteria.

The therapeutic properties of citrus fruits have been attributed to every constituent of these fruits, the oil in the peel, the citric acid, the acid salts, the bitter principle in grapefruit, the vitamins and other constituents. They have been offered as a safeguard against malaria, colds, indigestion, stomach ulcers, rheumatism, and so on. You may be of the opinion that you are reading the label on a bottle of patent medicine. Personally I don't like to think of an orange or tangerine as a dose of patent medicine. However, let us exam-

ine some of the constituents of citrus fruits and determine if possible what therapeutic value they have.

It is to Rumphius that the discovery that the juices of citrus fruits check perspiration and therefore quench thirst. These fruits also stimulate the appetite, increase salivary secretion and act on the kidneys. This is true not only of citrus fruits but of all fruits that contain appreciable amounts of organic acids and acid salts. Fruit acids check perspiration because these acids and salts acting on the kidneys cause the greater part of the water to be carried off through the kidneys instead of through the sweat glands. In general it may be said that the activity of the kidneys and skin as excretory organs are inversely proportional. When the skin is secreting large amounts of sweat the kidneys are secreting small amounts of urine. It is for this reason that fruits are especially recommended for summer and have value in the treatment of most any disease when the body is trying to eliminate toxins. Now let us examine this process a bit more in detail.

It is often very confusing to the housewife to read that the eating of fresh fruit produces an alkaline reaction. Let us consider that point; how can an acid fruit produce an alkaline reaction in the body? The acidity of the orange is due largely to potassium acid citrate and to citric acid. When the juice of an orange is taken into the digestive tract its odor, pleasing taste and acid properties increase the action of the salivary glands. The citric acid and the potassium acid citrate pass out of the stomach practically unchanged and enter the duodenum, the first division of the small intestines. Here the bases, principally sodium and potassium of the bile and intestinal juices react with the free citric and other acids and form the acid salts. The salts are now absorbed into the blood. These salts are the salts of weak acids and strong bases and are oxidized in the blood into carbonic acid which decomposes into carbon dioxide and water, leaving the free bases, sodium and potassium. The $CO_2$ is thrown off during respiration and the base left is known as the alkaline reserve.

Any excess of alkali above the reserve must be eliminated. The chief mode of elimination is through the kidneys. The presence of excess salts in the blood increases the osmotic pressure and fluid from the tissues is drawn into the blood. The capillary pressure on the secreting portions of kidneys is increased, therefore the excretion of water into the kidney tubules is increased. So much for the diuretic effect of citrus fruits.

Citrus fruits contain another class of compounds that are of interest and of which we know very little. These compounds are the glucosides. Grapefruit contains the glucoside naringen. The claim has often been made that naringen has the same properties as quinine. So far as experimental data are concerned, quinine and naringen have the bitter taste in common, and therefore belong to that class of drugs known as bitters. Investigation shows that the effect of bitters depends upon the bitter taste and that it is useless to administer them in the form of pills. According to Sollman bitters may be used to increase appetite, for whatever cause this may be deficient; to improve digestion, in all kinds of atonic dyspepsia. They tend to remove loss of appetite, oppression and constipation. They may be used as tonics in anemia, in convalescence and in wasting diseases to hasten reconstruction and as antiemetics. If it be true that it is permissible to class naringen as a bitter it is quite possible that a part at least of the therapeutic effect of grapefruit may be attributed to this bitter principle, though thus far there is no mention that naringen has been used as bitters.

The antiscorbutic action of fruits and especially citrus fruits has been known for generations. While most fruits are actively anti-scorbutic in the fresh state citrus fruits seem to possess this property to a very great extent. Long before there was a vitamin theory the value of citrus fruits as a cure of scurvy was well recognized. When fresh fruit and vegetables are absent from the diet of man or guinea pigs scurvy develops. This disease is characterized by soreness of the joints, with a tendency to hemorrhage, soreness of the gums, with a loosening of the teeth, and a fragility of the bones. Formerly this disease was somewhat prevalent among babies and among adults in times of long sea voyages. On diets

low in this vitamin children become irritable and show less desistance to infectious diseases.

A shortage of vitamin C is thought to be an important factor in the prevalence of tooth decay and much of the so-called rheumatism of children. Vitamin C is present in varying amounts in most fresh fruits and vegetables but citrus fruits apparently lead the list. It has been estimated that the minimum protective dose of lemon juice is approximately two ounces per day. Taking this as a standard for the juices of citrus fruits, peaches and apples are about one-half and pears one-fourth as potent. Papayas, pineapple and mangoes are also good sources of vitamin C.

Recent work has shown that vitamin C is a hexose acid now called ascorbic acid. Szent-Gyorgyi of the University of Szegid in Hungary discovered the antiscorbutic properties of paprika. From one liter of paprika juice 0.5 gm. of a crystalline substance was prepared and 0.5 mg. of this was protective for a guinea pig. Colormetric methods make it possible to determine the amount of ascorbic acid present without the long routine method of feeding animals. Further work has shown that this acid is stored in certain glands and tissues of the body, the adrenals and corpus luteum contain 1.4 to 2.3 mg. per gram of material, the liver, brain, testes and ovaries 0.1 to 0.4 mg. per gram, while the more active tissues such as the heart and muscle contain much less.

The tannins, mineral salts, and pigments are other constituents of citrus fruits which also contribute to their nutritive value. The gross mineral content of citrus fruits has been determined many times. Potassium, magnesium, chlorine, sulphur, sodium, calcium, phosphorus and iron have been shown to be present in rather constant amounts. Spectrographic analyses of the ash of these fruits show in addition to the above the following elements are present: barium, strontium, chromium, lead, manganese, aluminum, copper, zinc, silicon and boron.

The pigments, especially the yellow ones, are attracting considerable attention at the present. It has been found that carotene, one of the yellow pigments found in plants, is the precursor of vitamin A. This explains why the yellow fruits such oranges, tangerines, mangoes, are much better sources of vitamin A than grapefruit, lemons, pears and apples which are nearly colorless. Recent work has shown that there may be some relationship between the flavones, another one of the yellow pigments and vitamin G.

These substances which are present in small quantities and which have escaped the notice of analysts are now becoming the center of interest and the research of the future will be concerned with them. The difference between an orange and a grapefruit does not lie in the mineral constituents, in the sugar and water content, or in the acid or protein content but in certain as yet undetermined organic compounds. It is possible and quite probable that the research may show that citrus fruits contain other constituents invaluable to nutrition but at the present let us be content to urge the use of these fruits on the basis of what is known and not to make claims that cannot be substantiated.

## CITRUS ADVERTISING FROM THE GROWERS' POINT OF VIEW

**H. C. Case, Fort Myers**

The Society has asked me to outline the grower's point of view in relation to citrus advertising. Having been a substantial producer of citrus fruit for the past fourteen years, I appreciate this opportunity to explain my attitude toward industry advertising of citrus.

First, however, we should clearly define our understanding of the term "grower." Now a grower may own only a few trees on a city lot. The chances are this type of grower will give little thought to citrus advertising, for he will probably sell to local buyers what fruit he does not use himself. Or our grower may be the owner of a small grove, say, two to twenty acres. If

he is a member of a co-operative he will probably favor advertising; if he allows some marketing organization to handle his product he will probably realize the need for advertising; but if he sells for cash "on the tree" he may think advertising is the other fellow's worry, and fail to see the direct relationship of an active market, stimullated by advertising, to the price the buyer will pay him.

Then there is the large grove owner, or the stockholder in a corporation owning large acreage of groves. I believe that most of this class of growers, viewing their steadily declining returns of the past few years, are disposed to regard industry advertising as a crying need.

Again the grower may also be a shipper, owning both grove and packing plant, and if he is a co-operative grower, owning stock in a co-operative packing plant, he is also a "grower-shipper." Unquestionably the growers who are also shippers realize the value and necessity of advertising, but many hold back because they fear their competitors will benefit from their advertising effort without sharing in the expense.

We need to get away from the political attempt to divide the industry into growers on the one hand and shippers on the other, for many of our most substantial growers are also shippers (both independent and co-operative). I like the word "producer" better, for, after all, our effort is to increase the net return to the *producer* of Florida citrus, regardless of how else he may be classified.

The producers of Florida's citrus fruit now realize that it is not enough for one organization here and another there to spend a few hundred or a few thousand dollars in advertising their particular brands of fruit. In these days, when consumer demand is built and sustained on advertising alone (as witness the sudden advent and wide use of tomato juice, pineapple juice, prune juice, etc.) it becomes an economic necessity for any industry producing any great volume of a food product, to spend important money to advertise and promote the use of that product, else the attention of the public is diverted to other competing products and the market is lost.

The formula for the successful merchandising of any product today may almost be expressed in three words—"Standardize; Then Advertise." We are making progress toward standardizing our product, but we lack any comprehensive advertising effort.

Industry advertising is not an entirely new thing in Florida. We tried it out for two years through the Clearing House, with nearly 75% of the industry supporting the effort. The results were gratifying, although not continued long enough to get the cumulative effect of steady advertising. I participated in this effort and am thoroughly convinced it was a dividend-paying investment.

The effort was discontinued primarily because of the increasing resentment of those who were supporting the program and carrying the load for the industry, against those who refused to come in and bear their share of the burden, but nevertheless reaped their share of the benefits, meanwhile using the small advertising differential for competitive advantage.

Since then the industry has been without the benefit of any organized advertising effort, and we have seen the demand for Florida fruit, and especially grapefruit, steadily decline. There has been a corresponding decline in net returns to the producers. The well-advertised juice of the tomato, the pineapple and the prune have taken our market, while we have done nothing to hold or to increase the public favor for Florida's citrus fruit.

Grapefruit is fast disappearing from the American breakfast table, largely for lack of consistent advertising, and if it were not for the persistence of the medical fraternity in insisting upon the liberal use of grapefruit and grapefruit juice in the treatment of many forms of illness, and the small scale advertising done by individual shippers, plus the persistent radio jokes about the squirt of the grapefruit, I believe the average American would by now have forgotten there was such a fruit.

With oranges the case is different. Over a million dollars annually is spent by the growers of California oranges in advertising their product. Every grower of Florida oranges benefits thereby.

But no one advertises the tangerine! Here is a distinctive fruit of great merit, produced solely by Florida. There is no good reason why all our

output could not be sold at highly profitable prices if this fruit was properly advertised and merchandised.

I firmly believe that a preponderant majority of the producers of Florida's citrus fruit are sold on the necessity of immediate industry-wide participation in intelligent advertising and promotional work. How then can this be accomplished? There are two methods:

1. By voluntary agreement of a preponderant majority of the industry, or

2. By legislative action, levying an excise tax for advertising and thus providing for equal assessment of costs and equal participation in the benefits.

We have tried the first method, as I have outlined, but human nature being human nature it seems impossible to get all or practically all the producers of the State to come in on a truly cooperative advertising effort for the benefit of all.

Recently a group of Florida-minded men, headed by Mr. Lorenzo A, Wilson, have devoted untiring energy to secure a new voluntary advertising agreement in which not less that 80% of the industry would participate. Progress, I understand, has been rather disappointing, and although I understand the proposed set-up has recently been changed to provide control by representatives named by the industry, I am frankly doubtful if the 80% can be signed up. Nevertheless the efforts of Mr. Wilson and his associates have not been wasted, whether they succeed or not, and the industry should give them a hearty vote of thanks, for they have performed a great service in focusing the attention of the producers on the immediate need for industry advertising.

Personally, I am in favor of the voluntary method, *whenever it can be worked,* but it has been pretty well demonstrated that the producers of Florida's citrus will not all work together on anything, *voluntarily.* If Mr. Wilson and associates should succeed in getting 80% of the industry together on this advertising plan there would still be a considerable percentage riding free, and so long as any part of the industry rides free the same forces that wrecked the Clearing House advertising effort are at work to wreck any other voluntary effort.

Now as to the legislative method. Two years ago Clearing House growers initiated the movement to secure a marketing agreement under the Agricultural Adjustment Act, and one of their prime motives was the hope of securing thereby an advertising assessment against all Florida fruit, for the purpose of advertising that product. But advertising was quickly ruled out by AAA officials. It developed that it was not the object of the AAA to build up any industry by aiding it to normally expand its business by increasing the demand for its product. On the contrary, their sole plan was to restrict production, creating an artificial shortage by curtailing the volume of the product that might be moved to market, thereby (*theoretically*) increasing the per box return to the producer *for the amount he was permitted to sell.*

We have now had two years of experimentation along these lines, marked by a steady decrease in returns to the producers. I think these same producers, not only here, but throughout the country, are now pretty thoroughly convinced that the policy of destruction of a theoretical surplus of food (when that food is urgently needed by unemployed millions throughout the country) for the single purpose of creating a scarcity and thereby increasing prices, is a defeatist policy, and an un-American policy. It is the wrong approach to the problem of distribution. As long as American citizens are in dire need of the things other American citizens produce, all talk of overproduction rings false. We cannot create prosperity by putting the nation on short rations, at high prices, and the Florida grower cannot prosper by throwing away any part of his product.

The way to prosperity for us is to increase the consumer demand for our health-giving fruit by intelligent advertising and promotional work, and to supply that increased demand through intelligent merchandising.

Since Federal agencies have denied us the legislative method of industry advertising, we turn to our State government, and here, I believe, is the answer to our problem of industry advertising.

As the result of more than two months of continuous effort on the part of a large committee, representing producers both large and small, representing the Florida Citrus Exchange as an or-

ganization, representing the Associated Citrus Growers and Shippers of Florida as an organization, and representing most of the other independent producing and shipping interests in the State, an agreement has been reached on a set of advertising bills for oranges, grapefruit and tangerines. These bills have been introduced in both House and Senate and because the great majority of the industry is solidly behind them there seems to be good prospect of passage.

Briefly they propose to levy an excise tax of two cents per box on oranges, three cents on grapefruit and five cents on tangerines, for the purpose of advertising and the promotion of sales of Florida citrus fruit. The fund will be administered by the Florida Citrus Commission (created by another act) of eleven practical growers and grower-shippers appointed from all geographical sections of the State by the Governor. If passed these bills will give the industry a comprehensive advertising program, under control and direction of the industry itself, assessing the costs equally and extending the opportunity of equal benefits to all.

In conclusion I want to make it plain that I do not consider advertising alone a possible cure-all for the varied ills of the industry. Far from it! When a great industry ships the bulk of its product without knowing who, if anyone, is going to buy it; and when it permits the buyers (after the arrival of the fruit) to set the price they will pay for it—then the industry is not intelligently merchandising its product.

And when we permit quantities of our fruit to be purchased by canners (wo have no stake in the industry as producers) at prices far below the cost of production, and find that same fruit then being sold to the consumer in cans at less than our cost of bringing the fresh fruit to market, with the result that the market for fresh fruit at a profitable price is killed, we should realize that something must be done about this situation also.

But while we are working out these and other problems, we must realize that it is of paramount necessity that we advertise, consistently and continuously, for if we do not, the public attention will be diverted to other products, and markets once lost are difficult to regain.

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Mr. Case: I would like to say a word there in regard to the two cent tax on oranges, three cents on grapefruit anl five cents on tangerines. The committee itself was of various minds in regard to the amount we should levy on the different varieties of fruit, but there was no difference of opinion in regard to the soundness of the proposal as a whole and the necessity of this advertising bill. There was one member who thought we ought to start with as little as one cent a box. Others thought as much as ten cents a box. I have carefully canvassed many of the largest factors in this industry and this compromise was finally effected.

If the Society should see fit to approve this proposed levy by motion or by resolution, I am sure it would be of great assistance in the ultimate passage of the levies.

In conclusion, I want to say that I do not regard advertising as a cure-all for the ills of the Florida citrus industry.

The matter was referred to the Legislative Committee.

Speaker from the Floor: I believe Dr. Abbott and Mr. Case are on different sides of the question. Dr. Abbott believes grapefruit of little medicinal value and Mr. Case says if it were not for the doctors there would not be any grapefruit used.

I had an experience lately I feel it my duty to tell. My wife had been sick. She had been eating an apple a day, but got worse and worse, and the doctor said she must eat six grapefruit a day. She said it was impossible, she was full of acidity now, to which he replied that was his advice, but she was under no obligations to take his advice or pay for the call unless she would do as he requested. She tried it and persistently kept eating the fruit and drinking the juice and today she is a perfectly well woman; in fact, I don't know that I can say I am just as well pleased, because she has developed into a Maggie and I am the Jiggs and she can certainly use the rolling pin.

# WIDENING THE MARKETS FOR GRAPEFRUIT AND TANGERINES

**Earl W. Brown, DeLand**

The subject assigned me, "Widening the Market for Grapefruit and Tangerines," were I to discuss it in all its ramifications and detail as I understand it, would exhaust both you and me, and still only a beginning would be made. So, rather than this, we will deal with a few generalities concerning the necessity of publicity and advertising in present-day merchandizing, and shall recite a few specific reasons why a program embodying these essentials to success would prove most beneficial to the citrus industry of Florida.

As the standards of education have been raised by our constantly improving American system of public education and as the dissemination of knowledge and information has become more rapid and general—the press, the radio, the theaters and demonstrations all contributing in a large way—the successful manufacturers and the successful producer have learned to utilize these information distributing agencies as mediums of introductions and sales promotion for their respective products.

The public welcomes all such information and largely forms its opinion, its likes and its dislikes, from the information derived through the perusal of favorite publications, listening to the radio and by viewing such demonstrations and displays as come under its observation. In this manner a demand is created for a product, and the more carefully prepared the program, the greater the amount of research work done and the more basicly sound the reason given to the consumer why he should use the product, naturally then the results obtained will be the greater.

The establishment of new markets and the widening of the scope of established markets, are the natural sequences to increased consumer demand created in this manner. The ultimate and much to be desired results are a raised basic price level for the commodity.

Today, the Florida citrus crop is the most valuable commodity marketed in the United States without an effort to create a consumer demand being made in its behalf and with no supported effort to maintain a price level remunerative to the producer.

The fact that Florida today is a citrus producing state is due entirely to several reasons: the old law of the survival of the fittest; the glamour and romance of being a Florida citrus grower; and the fact that in the past money has been made in citrus culture; making exist a gambler's chnace that it may again become a remunerative vocation. This condition caused constantly shifting ownership of citrus properties, with new finances being injected into the industry, resulting in a continued production.

That oranges still are produced in Florida and are marketed on a remunerative basis, is in most instances due to the fact that we are selling these oranges under the umbrella of California's advertising, whereas grapefruit and tangerines (the two fruits in the production of which Florida is pre-eminent) are sent to market in most instances without a home or even an idea on the part of the shipper as to whether or not their sale will cover the cost of picking, packing, transportation and marketing, regardless of the cost of production.

Tangerines are produced in no other part of the world of such excellent quality and such attractive appearance, but due to lack of educational publicity, inferior Chinese tangerines sold on the Pacific coast bring up to one dollar a quart at Christmas, while the delectable quality of the Florida tangerine is unrecognized and unknown, and the fruit is permitted to decay on the trees because the consuming public never has had an opportunity to learn of its delicious flavor and attractive appearance, irrespective of its health-giving qualities.

Grapefruit producers of Florida are faced with a serious situation. Prior to the opening of the Florida market, each year the Porto Rican fruit is rushed to the larger American markets, causing a flooded condition to greet the Florida crop upon

arrival. Also, during the marketing period of Florida grapefruit, we now have the competition of Texas. Florida has 93,000 acres of producing grapefruit groves. Texas has planted over 90,000 acres, now producing or coming into production within the next few years. Despite this greatly increased production (more than 100% greater than that of a few years ago) nothing has been done to stimulate the sale of grapefruit other than the professional advice of certain physicians throughout the United States who advocate the use of grapefruit and grapefruit juice as a preventative and treatment for colds and influenza; while on the other hand grapefruit's competitors, tomato juice, pineapple juice, cranberry juice, sauerkraut juice, and prune juice, all are receiving the benefit and support of extensive publicity and advertising, as an evidence of which I quote you figures pertaining to the tomato juice industry:

In 1930, two hundred thousand cases of tomato juice were produced and considerable difficulty was encountered in their sale. Tomato juice producers have expended in the past four years in excess of $2,000,000 introducing and popularizing their product, with the result that in these four years the consumption of tomato juice in the United States has increased from 200,000 cases to over 7,000,000 cases, or an increase of 3,500%; while grapefruit, without the benefit of this supporting publicity and advertising, has dropped in popularity to the extent that figures released by the Pennsylvania Railroad dining car service during the past month reveal that, of the breakfast fruits consumed in their dining cars, grapefruit servings in the past few years have dropped from 47% to 29% and this is a fair criterion on which to base the loss in consumption of grapefruit throughout the nation.

Dr. Milton Henke, of the Sprague Memorial Institute, of the University of Chicago, has recently completed a four-year experiment with the children of Moosehart, Illinois, in which he has used citrus juice extensively in the diets of these children with a view to improving their dental structures. As a result of this, shown by photographic recordings and carefully kept records, it has been definitely determined that through the use of this citrus fruit and the minerals contained therein, the dental structures of these children have been improved to the extent that cavities have been actually grown out, decay has been arrested, and the crumbling of teeth has been stopped. Many chronic illnesses not included in the experiment have been greatly improved and in some instances have been cured.

It is also interesting to note the research work carried on by Dr. Ralph E. Barnes, who some years ago was in charge of Public Health Work for the United States government in Florida. Dr. Barnes, in his extensive experiments, has determined that due to present-day soft diets, the systems of the American people have become demineralized and that if it were possible to remineralize the systems of our people to the same extent they were thirty years ago when the coarser foods produced on the farm were used extensively in the diet, the health of the American nation as a whole would improve from four to six per cent. Dr. Barnes has also determined that the only feasible and logical method of remineralizing the systems of the American people is through the inclusion in the daily diet of Florida citrus fruits.

It is possible to recite many similar cases from unquestioned authorities, showing the advantages of citrus fruits and citrus juices in the daily diet, but time does not permit it and it is of no value to the Florida citrus industry as long as we are the only ones who know it and do not make it public for the edification of the American people and those of other nations, our potential citrus consumers.

There is no article of clothing worn by you today, from shoes to hats, nor is there an article of food other than the staples, in your pantry, that does not have the advantage of advertising and publicity. You do not wear an unknown brand of shoes, nor an unknown brand of clothes, nor an unknown make of hat. You do not use breakfast foods that are not given publicity and advertising through such mediums as the radio, magazines, etc. And yet, one of the finest foods, one of the foods most beneficial to the health of the nation, has never been given that advantage, and I refer to Florida citrus fruits.

We have associated with the Florida Citrus Institute at this time, Colonel H. F. Miller, who

was for a number of years the advertising manager of the International Harvester Company. He was responsible in a large measure for the introduction of the International Harvester machines to all parts of the world. Had it not been for the advertising and publicity given the International Harvester equipment, it could today be sold only in Chicago and its environs, where it is manufactured, as the rest of the world would not have had an opportunity of learning of its advantages and the economy of its use in the agricultural world.

If Henry Ford, in the manufacture of his automobiles, had not resorted to publicity and advertising, the Ford automobile would only be known in and about Dearborn, Michigan, where it is manufactured. His production today of 6,000 cars would have been mythical at best.

No later than last week, I had the opportunity of discussing publicity and advertising with Mr. Frank D. Bristley, the vice-president of the Royal Baking Powder Company, and he gave me some interesting facts and figures on the use of advertising of his product. He told me that today in Africa, 90% of the baking powder used in that continent is Royal Baking Powder, which sells at more than double the price of its nearest competitor, due entirely ot publicity and advertising combined with a high quality product.

The fact that the athletic coaches of our great universities utilize Florida citrus fruits in the training diet of their athletes, the fact that Sir Malcolm Campbell always drinks an eight ounce glass of Florida citrus juice before attempting to lower the world's land speed record set by him; the statements of Dr. John Harvey Kellogg, of Battle Creek (that great physician who has done so much for humanity in dietary treatments and who is a strong advocate of the use of Florida citrus fruits and citrus fruit juices in the daily diet) perhaps are known to you. But they are of no value to the Florida citrus growers in the marketing of their crops; they do not help to create a greater consumer demand, which is essential to the success of citrus production in the future. And why? Because *we* know this, but the American public does not. They can be educated only to these facts through the use of constructive publicity and advertising.

At the recent Century of Progress, the greatest exposition ever held in the history of the world not alone from the point of attendance, which was 40,000,000 people, nor from the fact that it ranked higher in artistic and educational values than any exposition ever held, but more particularly because it was the medium that brought together the people of the world and the states of this union where they could learn of the other sections of the United States and of the many things produced industrially and agriculturally in these states, Florida played a prominent role as there passed through Florida's several exhibits over twenty millions of people during the operative period of the years 1933 and 1934. We found, there in front of our citrus display, that everyone knew the oranges, but that many wanted to know if they were "Sunkist" oranges. A good portion of the people knew the grapefruit, due to the fact that their physicians had prescribed them in the treatment of influenza. Not more than one out of five people were familiar with the tangerine, having to ask what it was, how it tasted, what it was used for, etc., etc. Few people had used citrus juices; practically none had ever enjoyed frozen desserts made from Florida oranges, grapefruit and tangerines. It is not remarkable that these delectable concoctions rapidly achieved fame. In less than four months after its introduction, the Florida Exhibit sold 1,080,000 Florida Orange Sherbet cones, made from the pure juice of Florida tree-ripened oranges. It proved so popular that we granted the ice cream manufacturers in the Chicago area the privilege of manufacturing from our recipe for this Florida Orange Sherbet, provided that it would never be sold in any location unless it was made of Florida oranges only and provided that the sales establishments carried advertising in their windows and on their fountains to the effect that this was a Florida pure fruit product made from the juices of tree-ripened Florida oranges. Today over 1,400 stores in the Chicago area are selling this product and they are consuming 1½ carloads of Florida oranges every week in its manufacture.

We found in Chicago, in contacting the people of all states and those of many foreign countries,

a great interest in Florida's citrus fruits. We also found the lack of knowledge concerning these fruits most surprising. We were convinced of the need of some educational program in behalf of the citrus industry and to test this theory we endeavored to promote the sale of Florida citrus in the Chicago area through the use of the press and the radio in addition to our exhibit. We invested sixteen hundred dollars in a program of this character during the first year of the World's Fair (in 1933) supplemented by programs of music provided by Florida musicians. When we returned to Chicago in 1934 with Florida's exhibit, we consulted the marketing authorities and found that the sale of Florida citrus fruits in the Chicago area, due to the programs carried out in the limited way of the previous year, had increased 27%, whereas the sale of our competitive fruit had dropped nine per cent. These results were so outstanding that we conferred with many advertising executives of the big business institutions of Chicago. We laid all facts that had come to our knowledge before these executives, and as a result of their inspection and investigation, in each instance we were advised that the Florida citrus industry was not suffering from over-production, but, rather, was suffering tremendously from under-consumption, due to lack of educational publicity and advertising.

Upon the conclusion of the World's Fair, these facts were brought back to Florida and presented to our chairman, Honorable Lorenzo A. Wilson, who is well known to you and whose civic accomplishments need no iteration; also to Mr. Edward Ball, of the Florida National Bank group and of the duPont-Ball interests, who have perhaps invested more money in Florida and the future of this state, than any other group now operating in Florida.

The thought was advanced to these men that inasmuch as they were not directly interested in the production of citrus but had the interests of the state so much at heart and were financally able to do so, they could perform a most beneficial service to the state should they head an organization to be known as the Florida Citrus Institute whose sole objective would be to increase the national and international per capita consumption of Florida's fruit through educational publicity and advertising. They agreed to give their time and sufficient finances to bring this message to the Florida shippers and through the shippers to the growers.

A contract form was prepared which provided that every shipper who would agree to come into this organization would pay three cents per box on all fruits shipped by him, to be turned over to the Florida Citrus Institute; this contract not to become operative unless 80% of the industry signed contracts of this nature; that the controlling body would be a board of directors composed of all shippers who entered into agreement with the Citrus Institute; that this board of directors so created would select an executive committee of three to handle the affairs of the Institute during the interim between meetings of the board of directors; that the board of directors should recognize such organizations within the citrus industry as they deemed meritorious; and that each of these organizations so recognized should select one man from their group to act as a member of the Advisory Board whose sole function should be to inspect and pass on contracts for advertising and programs for publicity sponsored by the Institute.

We were advised that while our thought in this instance was highly meritorious and spelled success for the citrus industry, that it would not attain the success to which it was entitled due to the strife and contention existing within the industry. But despite this fact, I am pleased to report to you at this time that we hold definite pledges and contracts to the extent of 66¼% of the citrus production of Florida, based on the crop of 1933-34; the cost to the shipper to be three cents per box for fruit actually marketed next season, 1935-36.

News of this movement and of the co-operation in same by the Florida citrus growers and shippers, has reached selling agencies in the North, who have written the Institute offering their support. It has proved to be the one non-controversial program upon which the industry can unite for the betterment of all engaged therein. With the signing of 16% more of Florida's citrus production, the goal of the Florida Citrus Institute will

be possible, placing Florida citrus fruit among the agricultural products of the nation regarded as necessary foods, as a staple article of diet and no longer to be regarded as a luxury for occasional use only.

Research work *must be done.* Today the only research is that done by our competing state of California insofar as citrus fruits and citrus by-products are concerned. Naturally only those things that are beneficial to that state are given publicity, whereas those facts which have been determined as beneficial to Florida are deleted.

We have found that one box of cull oranges (today thrown away) will produce upward of three dollars' worth of commercial essential oils that can be procured at little expense. We have determined that the pectin of grapefruit is more valuable than that of apple pomace in the manufacture of small fruit preserves. There are hundreds of recipes for the use of citrus juices in delightful confections and desserts, of which the American public knows nothing. Strange as it may seem, in the near future the dehydrated skins of Florida oranges and grapefruit will form a component part of high-grade stock foods. Even the prunings and water sprouts from our citrus groves have a great value in an oil known as petitgrain derived by distillation from same and used largely as the basis for perfumes and in the manufacture of numerous commercial products.

The juice of Florida oranges, grapefruit, and tangerines, will improve the health of the nation. Their use has been found to be beneficial to the Dionne quintuplets of Canada and to neighbor John D. Rockefeller of Ormond (representing health in youth and in age). If it has been determined that citrus fruits will cure even defective dental structure and many chronic ailments, *why should we conceal this knowledge? Let's make it known to the world,* by utilizing the available and modern mediums of publicity and advertising, the radio, the press, by demonstration and through exhibits! If this is done, as it will be if the industry remains united in this effort, the entire area of Florida adapted to the production of citrus fruits, can be put in active and profitable production and our citrus industry will be on the remunerative basis it once was. The bugaboo of over-production and under-consumption will have been permanently laid to rest; the health of the nation will be improved, and *Florida again will have attained its place in the sun.*

## THE ROLE OF CITRUS JUICES IN HEALTH AND DISEASE

**Dr. Ralph E. Barnes, Chicago, Ill.**

It is indeed a pleasure and honor to be able to appear before this group of forward looking people. Florida has always had a very warm spot in my heart. It was here that I spent my most happy moments.

I sincerely hope nad trust that I may bring to you something of interest and value on this great subject of nutrition. It is such a large subject that I shall of necessity only hit the high spots.

Throughout this generalization I wish it to be made clear that to my mind Florida occupies a most unusual postition in this the most important field of human endeavor. Florida in my opinion is the best food supplying state in the Union. Bear this in mind as we try to give you some of the newer conceptions regarding nutrition and diets.

Had I the temerity twenty years ago to have given this talk no physician, physiologist or food chemist would have listened without saying it was nonsense. Today all scientific and professional people are convinced by the overwhelming evidence which proves that the statements are true and the practice is sound for both human and animal nutrition.

To digress for a moment we recall that an old

Spaniard, Ponce de Leon, once roamed over this vegetable paradise looking for a fountain of youth, trampling under foot with disdain that which truly holds the key to health, beauty and wealth.

When I studied nutrition in my college days there was little known of this newer knowledge of nutrition. All we studied, practically, or at least all I retained of that subject, was the calorie value of this or that food product. There was a hint of this newer knowledge in the study of scurvy, that scourge of the seafaring man. The addition of lemon juice to the diet prevented this dread disease and also cleared up the symptoms after they had made their appearance. It is for this reason that the British soldier is today called "Limey."

To my mind it is significant that the citrus fruits were the first, so far as we know, to be used in this way. We, of course, did not know the cause and effect that the citrus juices exerted upon the body at that time. Since then much progress has been made. Again I desire to keep before you that it was the citrus fruits which pointed the way to the study of nutrition which has proven so beneficial.

The life history of a human being or animal presents a series of epochs. The young if born of normal parents will start life with a fund of vitality, which it will not possess if the parents show poor development and chronic ill health. It passes from infancy to adult life and lives a varying length of time dependent upon the species. Some people live to be hale and hearty to 80 or more years of age, while others are broken in health at 35 and 40 or less.

It has been demonstrated many times that with a colony of small animals such as the domestic rat that the span of life within limits can be made anything desired. With ideal living conditions, conditions favorable to health and longevity, the life span may be lengthened or shortened depending upon the character of the food furnished them.

Our knowledge about the dietary properties of food has been gained by systematic experimentation and study on these small animals. The things studied are the rate of growth in the young, the size attained, the length of time required for completion of growth, the fertility and success of mothers in the rearing of the young, the ability of the females to bear the burden of repeated reproduction without showing signs of senility and the condition of the nervous system. Rats and other animals fed on certain faulty diets become nervous and apprehensive, whereas normal ones are free from these defects.

In feeding experiments extending now over 20 years Dr. McCollum reports that evidence of physical inferiority are found only in those groups in which the diet either of the parents or the young was unsatisfactory. When the diet is defective, abnormalities such as short and stock form, enlarged joints, defective teeth, runtiness, poor quality of hair, nervousness, abnormal fear, etc., have regularly appeared. Each special abnormality depending upon the nature of the dietary defect. Furthermore, these abnormalities are constant and always produced by the same dietary defect wherever present. We believe that we have sufficiently established this dietary principle as most exceedingly important.

Just what do we mean by the word food? For once I am really stumped. I have become so confused recently regarding this question. Daily I hear over the radio, read in the newspapers and receive through the mails great laudations of this or that compound. Just recently a product was offered in Chicago. You take a teaspoonful in a glass of water, and the refreshing draught will absolutely banish fatigue and revive you to a freshness unbelievable—not as a medicine, but, if you please, a food.

I still retain, however, a very clear conception of what a food should do—that is, it should promote growth, tissue repair, permit work, and maintain body temperature. People have always looked upon meats, grains, milk, fruits, and vegetables of many kinds as foods. By about 1870 chemists and physiologists came to realize that proteins, carbohydrates, fats and certain mineral elements were indispensable in the diet.

The body is a great chemical laboratory. The chemical processes which form the basis of life take place without exception among substances in solution in water. Water is therefore by far the most abundant substance in our body. We do not classify it a food since it undergoes no marked

change and leaves the body in the same form in which it entered. Water forms the medium in which living matter functions. It is very important that we replenish the supply frequently. Oxygen of the air is also indispensable to life. It is a component of almost everything we eat. In this respect we may classify oxygen as a food, but for convenience the oxygen of the air is not considered as a food, its function is to keep the fires burning thereby oxidizing the glucose, fats and various other substances for the purpose of providing the energy. Some of this energy is in the form of heat which maintains our temperature at the proper level.

So far as we know there are 37 simple chemical substances which in the right proportions would constitute an adequate diet to promote growth, tissue repair, permit work and maintain body temperature.

These 37 substances are 18 of the 22 amino acids found in proteins, glucose, eleven (11) inorganic elements, six vitamins and Linoleic acid. This most assuredly is a provisional list. In all probability the list of amino acids will be shortened and the list of vitamins will most certainly be extended. The blood and lymph are a dilute solution of these simple nutrients, with which they soothe the living cells constantly, at the same time furnishing the oxygen to maintain combustion. This tearing down and building up has been called metabolism. In health there is very fine balance among the hundreds of chemical transformations which are going on simultaneously, not as would occur were all materials in solution but side by side in orderly and progressive series.

The nutritive needs of the body have just been stated very briefly. What we know of the quality of foods we know in terms of what they provide. A deficiency of any of these 37 simple substances will produce a change from the normal and the continued deficiency wll create an abnormal condition called ill health.

Of these in their order we have the proteins with their 18 amino acids. These occur in both animal and vegetable foods. It would appear from our experiments that the mixed diets of both animal and vegetable diets are preferable to a strict vegetarian dietary. This due to the fact that certain amino acids essential to health are found in sufficient quantity in the animal kingdom.

In glucose we have the starches, the carbohydrate foods. Glucose is the one sugar which is constantly in the blood.

Since these two have received considerable attention for a great many years we will not discuss them further. Of the fats there are at least 15 kinds which occur regularly in our foods. Of these fats each contains different fatty acids, as you know fats are composed of glycerin and fatty acids. So far as we know all of these fatty acids except one are capable of synthesis within the body. This one, known to the chemists as linoleic acid, is an unstable compound easily oxidized. It is absolutely essential to normal nutrition.

We stated there are 11 inorganic elements which we know to be essential. A deficiency of any one of these elements will produce very definite conditions or abnormalities. They are calcium, phosphorus, sodium, potassium, magnesium, chlorine, iron, manganese, sulphur, copper and iodine. Others including zinc, nickel, cobolt, fluorine, silicon, boron, etc., are always found, but in very small amounts. We have so far been unable to prove that they play a part in the physiological processes.

Lastly we have the six vitamins which are essential. These are vitamins A, B, C. D, E, and G.

Since the mineral and vitamin studies really constitute this newer concept of nutrition we will confine our remarks to these substances and the nutritional disturbances their deficiencies create in the way of abnormal physiological processes.

Take vitamin A for example. Where a deficiency of this vitamin occurs there is a very decided inflammation of the eyelids. There is first a swelling of the eyelids followed by an inflamed condition of the inner surface of the eyelids. Bloody purulent discharges follow. Detailed studies convince us that all epithelial cells are involved. Even blindness may result.

There is in the retina of the eye a pigment known as visual purple. This is being constantly bleached when the eyes are used in bright sunlight. Vision may be fair in a bright light, but vision in a faint light will become defective with-

cut it. In vitamin A deficiency the power of the retina to regenerate visual purple is lost. The result is night blindness. In animals called moon blindness. It was early discovered that animals suffering from a deficiency of vitamin A rapidly developed respiratory infections, broncho-pneumonia, enteritis, abscesses at the base of the tongue and middle ear infections. So it has been named the anti-infective vitamin which seems not to be a well chosen term. Its chief role is apparently to keep mucous membranes intact and healthy so that they form an effective barrier between the blood stream and the bacteria. Vitamin A is formed in the liver from carotene, the yellow pigment of carrots. It is fat soluble and is found in fish oils, butter fat and egg yolk. It withstands cooking with little alteration. You may say that all yellow foods contain it.

Vitamin B is known as the anti-neurotic vitamin because nervous disturbances are prominent among the effects of the lack of it in the diet. Deficiency of this vitamin is the cause of the disease known as Beri-Beri which is common among the celestials, the ones who eat polished rice. It is water soluble and can be extracted from a long list of common foods. It is especially abundant in yeast and the germ of seeds. It is abundant in the wheat germ, but almost wholly lacking in the part which goes to make up our white flour. All leaves of plants contain it in abundance if fresh. The principal foods which do not contain it are sugar, starch, polished rice and white flour. It desists cooking with little damage.

Vitamin C is the anti-scorbutic vitamin. In the deficiency of vitamin C we see just as characteristic a type of malnutrition as of those just described. In vitamin A deficiency it is the epithelial tissues, in vitamin B the nervous system. In vitamin C deficiency it is the capillary system which is the seat of the injury. The dentine-forming cells in the teeth are even more sensitive to a lack of this vitamin than are the capillaries. In severe cases the endothelial cells forming the capillary walls separate and cause hemorrhage throughout the body. The bones become porous and fragile. The teeth become loose in the sockets. Scurvy in adults has been limited generally to sailors and soldiers, but has become common in bottle-fed infants after pasteurization of milk, where the mothers neglect to add orange juice to their diet. There is evidence that many adults secure less of vitamin C than they should for the promotion of optional health.

Household cooking destroys most of the vitamin C. Pasteurization of milk destroys most of it. Home canning destroys it also. However, commercial canning does not destroy it if the canning is done under the vacuum treatment before the cans are heated thus driving off the oxygen and preventing oxidation to occur.

The best source of vitamin C is paprika.

According to McCollum, oranges and lemons, the citrus fruits stand first in their content of this substance after paprika.

Vitamin D. The anti-rachitic vitamin. Rickets has long been exceedingly common among infants and children in the temperate climates, but rarely occurs in the tropics. The discovery of vitamin D and its relation to normal bone growth is one of the greatest contributions to Public Health. Here research unravelled a remarkable tangle of theories of this disease. It has to do with the proper calcification of the bones. It is found mostly in fish oils (cod and halibut). We as physicians had long believed in the efficacy of sunlight in the prevention and cure of rickets. The outstanding authority being Dr. Hess of New York. After the discovery of vitamin D in 1923 and the method of producing rickets it was soon discovered that rickets-producing diets did not produce the disease when the animals were exposed to sunlight or light especially rich in ultra violet rays. This soon led to the discovery that certain fats when exposed to the ultra violet rays certain substances were converted into vitamin D. This substance is known as ergosterol. Ergosterol is present in small amounts in the body including the skin. It is for this reason that children of the tropics exposed as they are to the direct rays of the sun a light rich in ultra violet rays developed vitamin D from the ever present ergosterol in their skins and thus do not have rickets. It was but a step from this to the exposure of various substances such as cod liver oil to increase its potency. This is called irradiation.

We do not know just how vitamin D acts. It is certain that it acts in some way to keep the concentration of both calcium and phosphorus in the blood at a normal level. There is a shortage of bone-forming elements in the American diet and it would appear that vitamin D acts to prevent mineral loss.

Vitamin E plays an indispensable role in reproduction. Its deficiency produces definite effects upon both male and female, but these effects are different in the two sexes. The addition of vitamin E will restore fertility to the female, but once the injury is done to the male it is almost impossible to restore the fertility to the male. Vitamin E is very widely distributed in nature.

There is little doubt that vitamin E is so commonly taken in ordinary foods that there is no reason to belive that human sterility results from a deficiency of this vitamin.

Vitamin G. In several parts of the world there is a disease known as pellagra, rough skin. There is a red rash on the skin of the face and hands. In severe cases a raw tongue and an uncontrollable diarrhoea. The sufferers waste to mere skeletons and ofttimes become demented. It is due to a faulty diet in which vitamin G is absent. It is now generally agreed that anyone who eats daily an ounce of yeast, or a half pound of lean meat, or who takes a quart of milks never need fear pellagra. Having discussed the vitamins briefly we will now discuss the eleven minerals which investigation has determined as essential to life.

The first and most important one is Calcium, which, with phosphorus, is necessary to bone formation. Without these two elements we would have a very faulty skeleton structure. Calcium must always be in the blood, for coagulation will not take place. Growing children require more calcium and phosphorus in proportion to their body weight than does the adult. That is during the bone formation period. A great deal has been written regarding the need for calcium by the pregnant woman to supply the necessary bone-forming material, but too little attention has been placed upon the need for a greater calcium intake during the nursing period. It has been determined that a pregnant woman requires 1.6 grains of calcium daily, the nursing mother still more. We could continue for some time regarding calcium and phosphorus. We will, however, desist from further discussion of these very important elements. Our purpose is to show something of their importance in the bodily economy.

Iron is found in the hemoglobin of the red blood corpuscle. Without iron the red blood cells cannot carry oxygen. The natural bloom of youth, the red lips, rosy cheeks are due to this pigment in the blood. The pale and anemic person has thin blood. Where there is a shortage of iron there will be found an anemia. Not all anemias are due to iron deficiency.

Closely allied with iron is copper. One of the most remarkable discoveries of recent years was the discovery that iron cannot be assimilated and converted into hemoglobin unless a little copper is present. Spinach, carrots, egg yolk, liver are rich in iron and copper.

Iodine is present in a very small quantity, but this is found almost exclusively in the thyroid gland and its absence is the cause of goiter. Where the iodine is absent from the soil goiter is prevalent. The Great Lakes region is an example of this fact.

Manganese has been very hard to study as it is very hard to get a diet free from this element. its deficiency, however, produces a peculiar nervous condition and unstability and the mothers have no maternal solicitude. They do not care for their offspring and the latter die in a few hours.

Sodium and potassium and magnesium is the form of salts of chlorine. Sulphur and phosphorus are the important elements which maintain the necessary alkalinity of the body. Their salts are called the buffer salts.

We have sketched rather briefly the question of nutrition. How can this apply to your problem? First let me say that our greatest source of these elements and vitamins are as indicated the great vegetable kingdom. However, no vegetable or fruit will contain these elements unless they are found in the soil in which they grow.

Now in taking up this phase of the work, I desire to make clear that I am a physician and not an expert in horticulture. What I have to

say may be very elementary to you who are specialists.

We desire to discuss the need of careful study of the soil and its improvement. This has been called fertilization, and in the past has been used primarily to increase the quantity of the product, but not necessarily the quality—an increase in the number of bushels of wheat per acre, etc., with only secondary considerations to the quality of the wheat.

Remineralization of the soil has several phases of interest, and I will report on an experience of last spring and summer to illustrate something of the study and work indicated.

The trees in the yard where I live failed to respond to the spring tonic and burst forth with all of its green finery. Result: some limbs were totally bare of leaves. Someone told the gardener that this condition was due to a lack of iron in the soil. He therefore put some iron in the soil near the roots, but without results. He spoke to me one day when I was passing and I became somewhat interested and rawing upon the rather new conception of iron digestion and utilization, I suggested the need of some copper to assist the iron. I knew that copper is necessary for the body to assimilate iron properly. My gardener friend was somewhat skeptical, but did consent to make a trial when assured it would do no harm. He therefore added a small amount of copper sulphate to the iron at the roots of one of the trees. The result was most startling, as the tree so treated with copper appeared to take on new vigor and regained its lost youthfulness, and the leaves came out on the bare limbs and were greener and more beautiful. The other tree continued to lag behind, and not until weeks later when the copper was added to its soil did it respond. I do not know just how far you experts have gone into this question, but I am sure there is still considerable to be done in this field.

In the illustration just cited, the trees were purely ornamental. How much more important, in case this tree had been a fruit tree and we could have studied the fruits before and after the chemicals were added to the soil. I am quite sure that such work on behalf of the fruits and vegetables will prove most interesting and also profitable.

We spoke of the necessity of standardization of certain products. I am quite sure that vitamin assays and chemical analyses of fruits and vegetables, seeking some standardization, will prove acceptable to the American public, and profitable to those who engage in this enterprise. In this field there is still much in the nature of research which promises rich rewards to those who have the temerity to engage therein.

Dated coffee recently came into being, with freshness indicated. Others are stepping out with complete analyses of their products. The most recent one is a yeast product which has a vitamin assay in units of each vitamin present, and also the exact chemicals and the amount of each stated clearly on the label.

This can be done for oranges, grapefruit, and other of the Florida products. Coupled with research to improve the quality, and then standardizing this quality, will bring great rewards to those so engaging.

Let us now take up the field of research as recently opened up in the results obtained by experimental diets. You no doubt are somewhat familiar with some of them. I will therefore only briefly discuss this field. In so doing, I desire to show you a certain trend of thought and also show you something which may be accomplished in this field. In 1933 Dr. Hanke published a research work entitled "Diet and Dental Health," in which he attempted to show that dental caries could be stopped by the liberal use of orange juice—a very important contribution. He even went so far as to say that in some instances where cavities had formed, he was able to correct the condition by the same diet.

Pyorrhea seems to be a condition somewhat akin to scurvy, and therefore probably can be prevented by proper diets. May I suggest a research into this field as most promising? Take the common cold, for example. Orange juice, with or without lemon juice or grapefruit juice over a period of twenty-four to forty-eight hours, will greatly relieve the condition and ofttimes effect a cure, depending upon the time it is instituted. The earlier it is used, the quicker and more lasting the results. To my mind, the citrus fruits

above all others should be the most promising for such studies.

We would be remiss if we should not mention one of the most promising fields, a field in which there has been so much progress, especially in view of this newer knowledge of nutrition. I have reference to the canning of foods. We are well aware that you have been canning grapefruit for several years. The advance in this field has been tremendous. There are today two definite objectives: that is, to preserve the fruit so as not to impair the vitamin content, and to keep intact the all-important inorganic salts.

It would appear from a perusal of the literature that there must be some other factor or factors involved in the digestion and assimilation of the citrus fruits. Certain facts stand out clearly with reference to vitamin C and the calcium content of the blood. Without going into the intricacies of the chemistry of saliva, let me say that at the Northwestern University they are doing some very interesting experiments on the chemistry of saliva. One of the experiments has to do with the solubility of the calcium found in the teeth, in saliva. While they are not ready to report on their findings, I am sure when they do some very interesting and valuable material will be available. It would be interesting in view of the known effect of citrus fruit juices on the gingival, to find out what effect if any these juices exert upon the saliva. The hint of unknown factors is so well defined that I feel sure that, with a better understanding of these factors, new and important uses will be found for citrus fruits.

To my mind there is no other group so potent and valuable as the citrus group. Yet the tangerines, kumquats, and satsumas are so little known that it is hard to find anything of value about them in the literature. What possibilities do they hold? What will be their future? Especially should you be interested in the tangerine, as Florida is the only place it can be grown in this country .

When I began thinking of this subject and started a perusal of the literature much to my amazement I found that I must of necessity depend upon the work done in California. I wrote to several investigators for suggestions and source material and without exception I was referred to California for information, not one reference to any work done on or in behalf of the Florida citrus fruits. Yet to my mind the Florida citrus fruits are superior in every way to any others. Your fruit is more juicy and more pleasant in taste. Florida by reputation does not get the benefit of the nutritional value of her foods.

As already stated, vitamin C is probably the most important vitamin in the promotion of health and must be supplied in sufficient quantity almost daily and, as pointed out, the citrus fruits are the best source of this most important substance. Also we show that in mineral content it is likewise important. From the charts shown here we can see that of the mineral elements so necessary those are found in these fruits in abundance.

Thus the newer knowledge of nutrition emphasizing the importance of vitamins and minerals should be a source of great value to all Florida fruits and vegetables. Here where the sun is a great deal brighter. The ultra violet rays are the most potent here and this is reflected in a better fruit.

However, the sun cannot do it all. Those of us who are students in this nutritional field recognize that while much progress has been made there is much to be done. It is for this reason that I am predicting that the next great advance in the prevention of physical abnormalities will be in this field. Will you profit as you should? With your wealth of sunshine and great variety of fruits and vegetables.

Truly the fountain of youth may be found here if we but dig deep enough into the soil of experience. Man should live to be 100 or more years. Given the necessary food and I am sure he will attain that goal.

Perhaps we have not talked enough about the Florida products. If so, I am sorry, as I felt that a generalization of this newer concept of the nutritional work would more clearly point the way when applied to your products than a more detailed description of the various fruits and vegetables grown here. The finding of newer uses for your citrus fruits and other products of your wonderful soil and climate should be a never ending quest.

You should be constantly testing your soils if you are not already so doing. Testing the fruits from that soil. Constantly adding to that soil those of the eleven elements enumerated and then testing the fruit from the soil so enriched. Vitamin and chemical assays should be frequently made and an effort to standardize your product regarding these especially desirable substances. Do not leave these things to chance. I am sure that with this accomplished your advertising agency will be able to disseminate this knowledge in such a manner that you will reap rich rewards in the increased usage of your products.

That there are other and valuable products yet to be discovered. Just this year came the recognition that the sap from Aloe vera is a very potent factor in the treatment of burns, especially of the X-Ray. What other hidden possibilities exist we cannot say. That many do exist is certain. I wish to acknowledge my indebtedness to Drs. McCollum of Hopkins and Sherman of Columbia as I have followed their works very closely in the preparation of this paper.

We hope that we have been able to make these truths clear. After all, the hard part has been in attempt to put into every day language these scientific facts, even at the risk of inaccuracies, too, that you can catch a vision of the program that has been made and also view a future filled with anticipation as to certain accomplishments which will make this a happier and healthier world.

## SOME FIELD EXPERIMENTS FOR THE CONTROL OF MELANOSE AND STEM-END ROT OF CITRUS

**Wm. A. Kuntz and Geo. D. Ruehle***

Two years ago in the Lake Wales meeting of this Society we presented a progress report on experiments for the control of melanose and stem-end rot. In that paper the need of a combined pruning and spraying program for the control of melanose was suggested and the statement was made that "a certain amount of infection with the melanose fungus, resulting in stem-end rot, takes place in the groves as the fruits are developing." Since that time a great amount of additional data have been accumulated on these problems. From these data we have selected some of the detailed figures obtained from two field experiments, which show the most clear-cut results that we have secured thus far. Results obtained in any field experiments vary from year to year, because of variations in environmental factors and of their effect upon the trees and the melanose fungus. However, these figures will serve to show the trends of results obtained by spraying and pruning for the control of melanose and stem-end rot.

The three phases of the problem that will be considered in this paper are: (1) the relative merits of some of the more common spray materials for the control of melanose fruit blemish, (2) a comparison of pruning and spraying and a combination of the two in a young grapefruit grove for melanose control, and (3) the effect of pruning and spraying on the control of stem-end rot in the fruits from this same young grapefruit grove.

One of the experiments was started at Babson Park in 1933. The grove consists of 25-year-old grapefruit trees of the "Gold Medal" variety with a few Marsh trees scattered throughout at irregular intervals. The trees have been well fertilized and pruned commercially. This first season some of the copper sprays were compared with some of the sulphur sprays, without the use of oil. A single application of two copper sprays, Bordeaux 1½-2-50 with a spreader, and Coposil 2½ pounds per 100 gallons, was made to two blocks of the trees in early April. At this time the first application of the four variations of the sulfur sprays was made to four other blocks. Following at two-week intervals, two more sulfur sprays were ap-

*Thanks are extended to Mr. O. D. Jaquess of Babson Park and Dr. Robt. L. McMullen of Largo for many courtesies and the use of parts of their groves.

plied to all of the plots, except the unsprayed check. Thus, the trees were sprayed three times in a period of six weeks.

The fruits were examined for the presence of melanose on September 8, 12 and 14 and grouped into five classes according to the number of blemishes per square inch. The percentage of fruits from each spray treatment falling into each class is shown in Table I. The results show that both the half-strength Bordeaux and the Coposil were superior to liquid lime-sulfur and liquid lime-sulfur with bentonite sulfur added, especially in the percentage of fruits free of melanose blemish. The colloidal form of sulfur, that is, the Sulfo-Spray, was the least effective in the control of melanose. By considering as first grade the fruits bearing from one to ten lesions per square inch, it may be seen that half-strength Bordeaux produced 90 per cent., Coposil 84 per cent., lime-sulfur with bentonite sulfur 79 per cent., lime-sulfur used alone 74 per cent. of first grade fruits, while the unsprayed checks produced about 53 per cent. of first grade fruits.

This is purely experimental spraying and, although lime-sulfur, especially with bentonite sulfur added, gave some control of melanose when applied at two-week intervals, the cost of making so many applications seems impractical.

In 1934 the experiment at Babson Park was continued on an expanded scale. That year the spray program was planned so that the time of application of some of the spray materials was varied; a larger number of spray materials was used and a follow-up spray with one per cent. oil was compared with lime-sulfur for combatting scale. This past year proved to be very favorable for melanose and, from the experimental point of view, the greater differences between sprayed and unsprayed trees are more significant.

The general set-up of the plots, with treatments and dates, and the results for 1934 at Babson Park are given in Table II. Final results were recorded

TABLE I

RESULTS OF SPRAYING EXPERIMENTS FOR THE CONTROL OF MELANOSE IN 1933
O. D. JAQUESS, BABSON PARK, FLA.

| Plot No. | Spray Treatment | Dates Applied | No. of Trees in Test | No. of Fruits Examined | Percentages of Fruits showing indicated number of melanose lesions per sq. inch | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | No Lesions | 1-10 | 11-25 | 26-50 | 50+ |
| 1 | (1) Coposil 2.5 lbs.—100 gallons<br>(2) Lime-sulfur 1-40<br>(3) Lime-sulfur 1-50 | Apr. 7<br>Apr. 20<br>May. 4 | 25 | 967* | 21.6 | 62.8 | 13.4 | 1.4 | 0.8 |
| 2 | (1) Bordeaux 1½-2-50 plus caseinate<br>(2) Lime sulfur 1-40<br>(3) Lime-sulfur 1-50 | Apr. 7<br>Apr. 20<br>May. 4 | 26 | 1008 | 37.8 | 52.9 | 8.4 | 0.7 | 0.2 |
| 3 | (1) Sulfo-spray 1-200<br>(2) Sulfo-spray 1-200<br>(3) Sulfo-spray 1-200 | Apr. 7<br>Apr. 21<br>May 5 | 40 | 1017 | 2.5 | 68.6 | 23.6 | 4.1 | 1.2 |
| 4 | (1) Sulfo-spray 1-100<br>(2) Sulfo-spray 1-100<br>(3) Sulfo-spray 1-100 | Apr. 7<br>Apr. 21<br>May 5 | 12 | 973 | 5.9 | 56.5 | 26.9 | 8.2 | 2.5 |
| 5 | (1) Lime-sulfur 1-40 plus Kolofog 4-100<br>(2) Lime-sulfur 1-40 plus Kolofog 4-100<br>(3) Lime-sulfur 1-50 plus Kolofog 4-100 | Apr. 6, 7<br>Apr. 20<br>May 4, 5 | 52 | 1016 | 14.7 | 64.7 | 17.4 | 2.3 | 0.9 |
| 6 | (1) Lime-sulfur 1-40<br>(2) Lime-sulfur 1-40<br>(3) Lime-sulfur 1-50 | Apr. 6<br>Apr. 20<br>May. 4 | 51 | 1004 | 5.2 | 69.2 | 20.0 | 4.5 | 1.1 |
| 7 | Check—unsprayed | | 52 | 1007 | 1.9 | 50.8 | 34.0 | 9.7 | 3.6 |

*Summary of both dropped and hanging fruits. Hanging fruits as reported by L. W. Ziegler.

from September 4 to 13 and the fruits were grouped into classes of infection as was done the previous year. By considering the first two classes of fruit as first grade, it will be seen that Bordeaux 3-4-50 applied in April followed by one per cent. oil in June, Bordeaux 1½-2-50 applied in April followed by two applications of lime-sulfur, basic copper sulfate with one per cent. oil applied in April and followed by one per cent. oil in June, and Bordeaux 1½-2-50 applied in April followed by oil in June gave best control of melanose. The early February or delayed dormant application of Bordeaux-oil 3-4-50 plus one per cent. oil, when followed either by two applications

TABLE II

RESULTS OF SPRAYING EXPERIMENTS FOR THE CONTROL OF MELANOSE IN 1934
O. D. JAQUESS GROVE, BABSON PARK, FLA.

| Plot No. | Spray Treatment | Dates Applied | No. of Trees in Test | No. of Fruits Examined | Percentages of Fruits showing indicated number of melanose lesions per sq. inch | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | No. Lesions | 1-10 | 11-25 | 26-50 | 50+ |
| 1 | (1) Bordeaux 1½-2-50 plus caseinate<br>(2) Lime-sulfur 1-40<br>(3) Lime-sulfur 1-40 plus caseinate | Apr. 9<br>Apr. 24<br>May 7 | 25 | 2000 | 5.2 | 71.3 | 17.4 | 4.6 | 2.5 |
| 2 | (1) Bordeaux 1½-2-50 plus caseinate<br>(4) One per cent. oil | Apr. 9<br>June 1 | 26 | 2000 | 2.2 | 60.8 | 27.9 | 7.1 | 2.0 |
| 3 | (0) Bordeaux 3-4-50 plus 1% oil<br>(2) Lime-sulfur 1-40<br>(3) Lime-sulfur 1-40 plus caseinate | Feb. 6<br>Apr. 24<br>May 7 | 26 | 2000 | 0.9 | 25.5 | 35.9 | 27.3 | 10.4 |
| 4 | (0) Bordeaux 3-4-50 plus 1% oil<br>(4) One per cent. oil | Feb. 6<br>June 1 | 26 | 2000 | 0.2 | 21.2 | 41.8 | 25.8 | 12.0 |
| 5 | (1) Lime-sulfur 1-40 plus Kolofog 4-100<br>(2) Lime-sulfur 1-40 plus Kolofog 4-100<br>(3) Lime-sulfur 1-40 plus Kolofog 4-100 | Apr. 10<br>Apr. 25<br>May 7 | 26 | 2000 | 0.9 | 25.2 | 35.2 | 28.1 | 10.6 |
| 6 | (1) Lime sulfur 1-40<br>(2) Lime-sulfur 1-40<br>(3) Lime-sulfur 1-40 plus caseinate | Apr. 10<br>Apr. 24<br>May 7 | 26 | 2000 | 0.3 | 19.3 | 43.3 | 29.1 | 8.0 |
| 7 | (0) Dupont No. 2. 1-60<br>(1) Dupont No. 2. 1-60 | Feb. 6<br>Apr. 9 | 25 | 2000 | 0.0 | 10.0 | 34.5 | 40.0 | 15.5 |
| 8 | (0) Dupont No. 2. 1-60 | Feb. 6 | 26 | 2000 | 0.0 | 9.7 | 36.6 | 39.5 | 14.2 |
| 9 | (1) Basic copper sulfate 1½-50 plus caseinate<br>(2) Lime-sulfur 1-40<br>(3) Lime-sulfur 1-40 plus caseinate | Apr. 9<br>Apr. 24<br>May 7 | 26 | 2000 | 0.9 | 48.5 | 36.0 | 11.7 | 2.9 |
| 10 | (1) Basic copper sulfate plus caseinate plus oil<br>(4) One per cent. oil | Apr. 10<br>June 2 | 26 | 2000 | 0.8 | 64.2 | 30.9 | 3.3 | 0.8 |
| 11 | (1) Bordol-Mulsion 1-50 plus caseinate<br>(4) One per cent. oil | Apr. 10<br>June 1 | 26 | 2000 | 0.1 | 33.9 | 45.9 | 15.9 | 4.2 |
| 12 | (1) Bordeaux 3-4-50 plus caseinate<br>(4) One per cent. oil | Apr. 10<br>June 1, 2 | 26 | 2000 | 2.3 | 74.9 | 20.9 | 1.6 | 0.3 |
| 13 | Unsprayed (check) | | 52 | 2000 | 0.0 | 6.4 | 22.6 | 44.3 | 26.7 |

of lime-sulfur in April and May or by oil in June was much less effective than when it was applied in April. Furthermore, lime-sulfur apparently had little effect in further reducing the percentage of melanose blemish when applied following a dormant application of Bordeaux. Again, the sulfurs alone gave very poor control of melanose.

From the results of these two years' experiments, it is probable that growers will wish to adopt a spray program. In selecting the kinds and amounts of materials to use, it is well to bear in mind certain points in connection with the use of them that were observed during these tests. (1) The use of Bordeaux-oil seems limited. Best results were obtained when the Bordeaux was applied in April soon after the fruit is set. If oil is applied in combination with Brodeaux, there is danger of burning and shadowing the young fruits. This is true with most of the commercial grades of oil. (2) Half-strength Bordeaux, when applied at the proper time, has proved about as effective for the control of melanose as full-strength, 3-4-50. A little better results were obtained by following this weaker Bordeaux with lime-sulfur than by following with oil. Half-strength Bordeaux lessens the amount of residue left on the foliage. It also lessens the amount of copper which is applied per tree, which should not be so injurious to the trees. (3) Some of the commercial forms of the copper sprays appear about as effective as half-strength Bordeaux for the control of melanose and they leave very little residue. Many of these materials are relatively new and should be tested further to insure their proper use on citrus. (4) Bordeaux applied during the dormant season reduces the amount of melanose fruit blemish, but not sufficiently to justify its use in older groves for this purpose alone. (5) The sulfur materials which have been tried are less effective than the copper sprays in the control of melanose fruit blemish.

In the second and third phases of this paper, experiments conducted in a single block of trees located at the Citrus Experiment Station will be discussed. This planting consists of ten-year-old grapefruit trees with a total of 512 trees divided equally among the Excelsior, Duncan, Marsh and Walters varieties, planted in row sequence. The rows of these varieties are 16 trees deep running in the east-west direction; the repetition of the four varieties takes place eight times in the north-south direction.The planting was divided into eight two-row plots; two plots each receiving one of the following four treatments: (1) neither pruned nor sprayed, (2) sprayed but not pruned, (3) pruned but not sprayed, (4) pruned and sprayed. This experiment was started in May, 1932. Pruning has been done regularly in this grove, the first year in May, then in February, and this past season in March because of cold damage to some of the trees. The grove has been sprayed about April 15-20 of each year with a Bordeaux mixture. This is followed regularly in May or June with a one per cent. oil, and the entire planting usually receives a one per cent. oil in the fall. Estimated cost of the operations per tree has been 13.8 cents and 18.3 cents, respectively, for the two years.

The results in this grove last season were very clear-cut. A summary of results obtained from all four varieties in fruit blemish control and the subsequent development of stem-end rot in 3,200 of these fruits, when they were held in shed storage for 60-65 days are shown in Table III. It may be seen that the sprayed and pruned trees showed about two per cent. of second grade fruits, and the total stem-end rot in fruit from these trees was 15 per cent. The sprayed but not pruned trees showed about eight per cent. second grade fruits. which developed about 29 per cent. stem-end rot. The pruned but not sprayed trees showed about 53 per cent. second grade fruits with 54 per cent. stem-end rot. The fruits from the trees which were neither pruned nor sprayed showed about 78 per cent. second grade fruits with 60 per cent. stem-end rot. Of the total fruits rotted, less than two per cent. was caused by organisms other than the melanose fungus.

This is the most clear-cut evidence that we have secured on these two points. There is every indication in all of our work with melanose that spraying, if properly handled, is superior to pruning alone, for melanose control. And yet in older groves, there is also every indication that spraying alone (with one application of the fungicide) will not produce the maximum control of this disease.

In the McMullen Grove near Largo, on old grapefruit trees in 1933, 55 to 75 per cent. of estimated first grade fruits were obtained from unpruned trees, but when similar trees were pruned and then sprayed, this estimated first grade was increased by about ten per cent. In 1934, with 73 to 83 per cent. first grade fruits, the first grade was again increased by about ten per cent. in the pruned trees. It seems, as the grove becomes older, that the fungus becomes more general and abundant, so that for the maximum control one must either use more applications or prune and spray. Observations on the trees indicate that large amounts of Bordeaux may injure the trees.

In the matter of stem-end rot control, it is apparent that there is a lessening of stem-end rot after Bordeaux spraying. Fulton reported this condition some years ago. In cleaning up your groves, it seems that you will be lessening the field infection, which later leads to stem-end rot in transit and storage.

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Mr. O'Byrne: May I ask Mr. Kuntz a question? Is it important to haul the prunings out of the grove or is it all right to leave them under the trees?

Mr. Kuntz: I don't know. That question came up two years ago and we are no nearer knowing now than then. Dr. Ruehle has been doing some technical work with the wood, but we have not as yet secured a culture on the wood of the fungus. That is what is holding up our investigation of that stage, because the perfect spore stage of fungus is produced underneath the wood as it lies under the tree. So we are just running into one of those things that we cannot solve off-hand.

Question: Is it necessary to disinfect your pruning tools?

Mr. Kuntz: We have not been doing that because of difficulty in disinfection. When you have to carry a supply of formaldehyde or bichloride with you, you are slowing up your operations. Unless we find it absolutely necessary, we would not recommend it in ordinary pruning operations.

Question: Do I understand that if you should spray twice you could get much better control or nearly as good a control as if you sprayed and pruned?

Mr. Kuntz: From the little experience I have had with pruning and the few observations I have made in that pruning operation you will be reinvigorating your trees to the extent that you yourself will marvel at its results. I hope any horticulturist at this meeting will forgive me for transgressing. That what I say from the standpoint of disease, control of bloom and from the standpoint of your trees is recommended because there is a physiological and horticultural effect there. You

TABLE III

RESULTS OF SPRAYING AND PRUNING FOR THE CONTROL OF MELANOSE AND STEM-END ROT IN GRAPEFRUIT, CITRUS EXP. STATION
1934-35*

| Plot No. | Treatment | Fruit Blemish Control | | | | | | Stem-end Rot Control | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Percentage in No. lesions per sq. inch | | | | | | Stem-end Rots | | | |
| | | No. of Fruits | No. Lesions | 1-10 | 11-25 | 26-50 | 50+ | No. of Fruits | Phomopsis | Diplodia | Misc. Rots | Percentage of Total Fruits Rotted |
| 1, 8 | Unsprayed, unpruned | 4000 | 0.02 | 22.1 | 34.1 | 24.3 | 19.5 | 800 | 479 | 2 | 2 | 60.1 |
| 2, 7 | Sprayed, unpruned | 4000 | 28.5 | 64.0 | 6.9 | 0.5 | 0.1 | 800 | 230 | 3 | 2 | 29.1 |
| 3, 6 | Unsprayed, pruned | 4000 | 0.02 | 46.7 | 44.3 | 7.3 | 1.6 | 800 | 429 | 4 | 3 | 54.1 |
| 4, 5 | Sprayed and pruned | 4000 | 56.9 | 41.0 | 1.9 | 0.1 | 0.05 | 800 | 117 | 3 | 3 | 15.0 |

*Sprayed April 17-18, 1934. Pruned in February.

don't realize till you take some old tree, knock the wood out of it, give it normal fertilization and see your results the first year. I don't know the details of it, but it is visible to me as I prune trees. I have not answered your question about two applications of spray material. In your land, which is heavier and of more tenacious type, where we have irrigation, I don't doubt you can continue with two applications of spray material, but in some of the high ridgeland, I would suggest as far as possible that you limit yourself to one application of copper spray per season if you can.

Question: Have you any records of whether the fallen fruit is detrimental to a grove?

Mr. Kuntz: From the work of Fawcett some years ago he showed that organisms only developed on that fruit under extremely moist conditions. Sometimes you will see it on that fallen fruit, but it is a rare condition. You can produce it in the laboratory and keep it under moist conditions, but as a rule the fallen fruit in melanose and stem-end rot is considered of little importance.

Question: Have you any records of whether any beneficial effect is noted from fallen fruit as to fertilization?

Mr. Kuntz: When it comes to fertilization, I must beg the question. I know nothing about it.

Question: Will you say a word as to the residue of various sprays on the trees and its effects?

Mr. Kuntz: I know very little about that. I am trying to control melanose and that is all I can do. Maybe some of the others on the program can give you some information. I have no data. The question of spray residues and the amount of copper, of course, is important, on foliage, but we have not been able to get into any analytical work as to how long copper or lime stays there. There may be important features, especially in connection with a follow-up program.

Mr. O'Byrne: Mr. President, might I just say that I believe I speak for very many when I say that we appreciate the clearness with which this data has been presented. It has not been confused. We have seen the picture.

## SPRAYING FOR THE CONTROL OF CITRUS SCAB

**Geo. D. Ruehle**
**Citrus Experiment Station, Lake Alfred**

As early as 1896, Swingle and Webber reported that citrus scab could be controlled by spraying with bordeaux mixture or ammoniacal solution of copper carbonate. Later pathologists in Florida, especially Fawcett (1912), Grossenbacher (1916) and Winston (1923), repeatedly demonstrated that the disease could be effectively controlled by spraying. Commercial control of the disease by this means has also been reported in Porto Rico, Argentina, New South Wales, and other citrus producing regions where the disease is of importance. In all of these spraying experiments, bordeaux mixture has been found to be the most effective fungicide tested.

The chief objection to bordeaux mixture on Florida citrus is that its use leads to an increase in numbers of scale insects, and necessitates the application of one or more scalecides later in the season. With the introduction of the bordeaux-oil emulsion combination about 1920, it was hoped that disease and scale control could be accomplished at the same time. Later experience, however, showed that while the bordeaur-oil emulsion possessed advantages over plain bordeaux as a spray for citrus, the former could not be relied upon to control the scale insects. It has been the experience of a large number of growers that spraying with an oil emulsion to check scale increase was necessary whether oil was added or left out of the spring applications of bordeaux mixture.

In the earlier spraying experiments, lime-sulfur sprays proved to be of some value for scab control, but were generally much less effective than bordeaux mixture. The use of lime-sulfurs in disease control on citrus, however, aids greatly in the control of rust mites, red spiders and scales.

Because of this, some growers still rely upon lime-sulfur for the control of citrus scab.

In recent years, new forms of sulfur, copper and other chemicals have been introduced to combat fungous diseases. With the aim of testing the more promising of these new sprays for scab control, or of so modifying the spraying program then in practice, so that it would prove less troublesome in promoting scale increase, a new series of spraying experiments was begun in 1932.

### SPRAYING EXPERIMENTS IN 1932

The experiments performed in 1932 were more or less preliminary, to test out the relative effectiveness of the standard bordeaux and lime-sulfur programs in use for the control of scab and to secure a comparison of some of the newer fungicides with these standard spray materials. Combinations of fungicides in any one plot were avoided in order to determine the relative effectiveness of each material. Unfortunately, in the season of 1932, a prolonged drouth occurred during the spring months, which had the effect of retarding both the development of the causal fungus and of the citrus trees. There is little doubt that the effectiveness of some of the spray materials was modified by these abnormal weather conditions.

The experiments were conducted in three different groves in widely separated localities. One was located near Vero Beach on grapefruit, a second near Bradenton on grapefruit and the third at Lake Alfred on scattered plantings of tangelos and King oranges. An adequate number of trees were left unsprayed in each grove to serve as checks. To determine the amount of control obtained, a representative number of fruits were examined from each plot, after the danger of further infection to the fruit was passed. Wherever the size of the plot permitted, 1,000 fruits were examined at random, and these were graded according to the severity of scab infection.

The results of these experiments confirmed the conclusions of earlier workers that bordeaux mixture was the most reliable fungicide then available for the control of citrus scab. From 89 to 96 per cent. scab-free fruits were produced in the various plots where dormant and bloom applications of this fungicide were made, as compared to 3.6 to 29 per cent. scab-free fruits in unsprayed check trees in these same groves. Somewhat better control resulted when oil emulsion or calcium caseinate were added to the mixture, than when it was used plain. At Bradenton, a single application of bordeaux-oil emulsion in the bloom produced 69 per cent. scab-free fruit, as compared to 94 per cent. in the plot where dormant and bloom applications of this spray were made, and to 26 per cent. in the unsprayed check trees in the same grove. In all of the plots receiving either bordeaux mixture or bordeaux-oil emulsion, it was necessary to apply oil emulsion later to prevent serious damage from scales.

Copper cyanamide proved less effective than bordeaux mixture and its use led to a large increase in numbers of scale insects. An organic mercury emulsion when made up as a spray with hard water containing sulfur gave practically no reduction in the percentage of scabby fruit, but was effective for the control of purple scale.

Commercial control was not obtained with any of the sulfur compounds tested, including liquid lime-sulfur, dry lime-sulfur, bentonite sulfur, and colloidal sulfur. Of these, the liquid lime-sulfur, used at 1 to 25 dilution as a dormant spray and at 1 to 40 dilution in the bloom, gave the best results. Whenever a severe infection of scab is expected, lime-sulfur alone should not be relied upon for control of the disease. The results obtained on Sampson tangelos at Lake Alfred, illustrate what may happen when lime-sulfur is used to combat severe infection. Twelve per cent. scab-free fruit was produced in the plot where dormant and bloom applications of lime-sulfur were made, as compared to 3.6 per cent. scab-free fruit in the unsprayed trees and 96 per cent. scab-free fruit in the trees sprayed twice with bordeaux mixture.

### SPRAYING EXPERIMENTS IN 1933

Spraying experiments for the control of scab were repeated in the same localities in 1933. At Vero Beach, in a grove of Marsh grapefruit which had not been sprayed for scab in 1932, three different schedules were compared. In one plot, an attempt was made to control the disease with liquid lime-sulfur combined with bentonite sulfur. In another, a dormant application of bordeaux-oil emulsion was followed by three lime-sulfur sprays for scale control. In a third plot, a dormant ap-

plication of bordeaux-oil emulsion was followed by a bloom spray of bordeaux, and an oil emulsion was applied later for scale control.

A similar experiment was performed on seeded grapefruit near Bradenton, with some variations in the spray formulas. Wettable sulfur was combined with liquid lime-sulfur in the sulfur plot, and in the plot receiving two bordeaux sprays, a 2-4-50 formula was used instead of the standard 3-4-50 mixture. In both experiments a scale count was made from the trees before the dormant sprays were applied, and again in the fall, to check on the effect of the various schedules on the scale population.

Several new combinations were tested for control of scab blemish on tangelos at Lake Alfred.

Two applications of bordeaux mixture, the first as a dormant spray with 1 per cent. oil emulsion added, and the second just after the petals had fallen, without the addition of oil, again gave the most effective control. The 3-4-50 formula produced 97 per cent. scab-free fruit in the Vero Beach plot, and 87 per cent. was free of scab blemish in the Bradenton plot where the 2-4-50 formula was used. The unsprayed check trees in both groves showed 19 per cent. of the fruits free of scab blemish. Scale increase was high in both localities, but was more serious in the Bradenton plot where less copper but the same amount of lime was applied.

Satisfactory commercial control of scab was obtained in plots in both localities by applying bordeaux-oil emulsion just before the spring growth started, following after the bloom with 1-40 lime-sulfur and with two later sprayings of 1-50 lime-sulfur. No serious damage resulted from scale increase in these plots. Trees sprayed in 1932 with two bordeaux sprays showed a marked reduction in amount and severity of infection in 1933, without further sprays being applied.

The addition of the bentonite sulfur at the rate of 7.5 pounds to 100 gallons of liquid lime-sulfur was much more effective for scab control than straight lime-sulfur. Sixty-three per cent. scab-free fruits were produced at Vero Beach from two applications of this spray as compared to 19 per cent. unblemished by scab in the check plot. Plain wettable sulfur added to lime-sulfur was much less effective.

An ethyl mercury oleate oil emulsion formula containing 20 per cent. more fungicide than the formula used in 1932, when mixed as a spray with water free of sulfur, gave fair commercial control of scab on Samson tangelos at Lake Alfred. A stimulation of growth of the trees apparently resulted from the use of this material. Preliminary experiments with tung-oil emulsion as a spreader for bordeaux mixture, while far from conclusive, indicate that this oil is less effective in checking scale insects, and has no special advantage over proprietary oil emulsions as a spreader for bordeaux as used on citrus foliage.

### SPRAYING EXPERIMENTS IN 1934

Spraying experiments for the control of scab were again carried out at Bradenton, Lake Alfred and Vero Beach. At Bradenton, the same plots sprayed in 1933, were again sprayed experimentally in 1934. The trees in three plots received a 3-4-50 bordeaux mixture with one per cent. oil added, just before the spring growth appeared. In one plot, no further fungicides were applied, but an application of oil emulsion was made in June for the control of purple scale. A second plot received a 1-40 liquid lime-sulfur spray in the last of the bloom, and this application was repeated twenty-four days later. The third plot was sprayed on the same dates with dry lime-sulfur 5 pounds to 100 gallons plus Kolofog 2 pounds to 100 gallons. No oil emulsion was used after the bloom in these two plots. When the records of scab infection on the fruits were taken, approximately 20 per cent. of the fruits from unsprayed trees were blemished by scab. The control of this blemish in all three sprayed plots was nearly absolute. A scale count made in December from all the plots showed that the control of purple scale was as good in the trees receiving two sulfur sprays as in those sprayed with the oil emulsion.

In collaboration with Mr. W. L. Thompson, an experiment was carried out at the Ensley grove, near Bradenton, for the control of red and purple scales after scab control measures had been applied. The experiment included twelve plots, each consisting of 28 grapefruit trees of a seeded variety, which were ten years of age at the begin-

ning of the experiment. In ten of the plots, the trees received a dormant application of either bordeaux-oil emulsion or bordeaux mixture plus a caseinate spreader. Certain of these plots were sprayed after the bloom with oil emulsion, while others received three applications of various combinations of sulfur sprays for scale control. No records of scab control on the fruit were made, because a light bloom appeared in only a few scattered trees in the entire planting. Some interesting data were secured on scale control following the use of boredaux mixture. These results will be discussed later in the program by Mr. Thompson.

At Lake Alfred, an organic mercury oil emulsion, containing phenyl mercury oleate as the fungicide, was tried out for scab control on infected Samson tangelo and King orange trees. Two applications of this spray at 1 to 60 dilution gave practically no reduction of scab blemish. Both the sprayed and unsprayed trees were severely infected. Basic copper sulfate was also tested on the same varieties. This powdered form of copper was applied at the rate of three pounds to 100 gallons of water with calcium caseinate added. Two applications of this material, the first made just before the spring growth started, and the second made in the last of the bloom, gave excellent control of scab blemish on the fruit. No injury resulted from either application.

The experiment at Vero Beach was carried out in the same grove used in 1933, but the number of plots was increased to eleven, consisting of 36 trees each. An opportunity was presented to further observe the residual effect of the spraying done the previous year.

The final records of the control of scab blemish on the fruits were taken June 8. On this date the fruits were practically all well past the susceptible stage for scab infection. In order to determine whether the fungicides applied for the control of scab were effective in reducing melanose blemish on grapefruit, 1000 matured fruits were examined from each plot in November, and the degree of melanose blemish was determined by counting the number of melanose lesions per square inch field from the upper half of each fruit. The scale count from leaves collected from all the plots was made late in October.

The spray formulas, with the dates of application and the results of the examinations made to determine the amount of scab and melanose blemish and the number of living scale insects per leaf, are recorded in Table I.

The unsprayed trees in Plot 1 became very severely infected with scab and melanose. Of the 1,000 fruits examined, only 31 were free of scab blemish. Approximately 30 per cent. of the fruits were classified as lightly infected in the melanose examination.

Two applications of basic copper sulfate to Plot 2 gave as good control of scab and melanose as two applications of bordeaux to Plot 3. The basic copper sulfate combines readily with an oil emulsion and is much easier to mix than bordeaux. Since it is not necessary to add lime to it, there is very little visible residue on the foliage after its use. An injury to the foliage in the form of "star melanose" followed its use in this plot. This injury was not serious and is frequently observed after bordeaux or other copper sprays are applied to grapefruit foliage.

The control of scab and melanose in Plots 7, 9, 10 and 11, was practically the same, and the slight differences may be attributed to experimental error. The control obtained in these plots evidently resulted entirely from the dormant spray, because it was as good in Plot 11, where the dormant spray was not followed by other fungicides, as in Plots 7, 9 and 10, where sulfur sprays were applied after the bloom.

In Plot 8, where lime-sulfur plus bentonite sulfur was applied to trees which had received two sprayings of bordeaux mixture in 1933, the control of scab was excellent, only 6.4 per cent. of the fruits being infected. The melanose control secured by this combination was very slight, however.

In Plot 4, the Bordol-Mulsion, which is a proprietary copper-oil emulsion spray sold as a substitute for home-made bordeaux-oil emulsion, did not prove as effective as the latter for the control of either disease. Neither of the mercury oil emulsions used in Plots 5 and 6 gave commercial control of scab or melanose.

Red and purple scales increased during the season in all plots including the check. This increase

## TABLE I

RESULTS OBTAINED FROM THE USE OF VARIOUS MATERIALS FOR THE CONTROL OF SCAB ON GRAPEFRUIT AT VERO BEACH IN 1934

| Plot No. | Materials and Concentrations | Date Applied | Scab Blemish on Fruit | | Melanose Lesions on Matured Fruit per square Inch Field | | | Scale Infestation | |
|---|---|---|---|---|---|---|---|---|---|
| | | | None | Present | 0-10 | 11-50 | More than 50 | Live Scales per Leaf in January, 1934 | Live Scales per Leaf in October, 1934 |
| | | | Per cent. | Per cent. | Per cent. | Per cent. | Per cent. | | |
| 1 | None—unsprayed check | | 3.1 | 96.9 | 30.5 | 60.2 | 9.3 | .56 | 1.8 |
| 2 | (1) basic copper sulfate 1½-50 plus 1% oil<br>(2) basic copper sulfate 1½-50 plus caseinate<br>(3) oil emulsion 1-80 (approx. 1% oil) | Jan. 25<br>Apr. 13<br>June 7 | 97.5 | 2.5 | 87.7 | 11.9 | .4 | .72 | 5.7 |
| 3 | (1) bordeaux 3-4-50 plus 1% oil<br>(2) bordeaux 1½-2-50 plus caseinate<br>(3) oil emulsion 1-80 (approx. 1% oil) | Jan. 25<br>Apr. 13<br>June 7 | 95.3 | 4.7 | 82.9 | 16.1 | 1.0 | .98 | 7.7 |
| 4 | (1) Bordol-Mulsion 1-40<br>(2) Bordol-Mulsion 1-50 | Jan. 25<br>Apr. 13 | 79.8 | 20.2 | 76.9 | 22.2 | .9 | .80 | 3.2 |
| 5 | (1) phenyl mercury oleate-oil emulsion 1-60<br>(2) phenyl mercury oleate-oil emulsion 1-60 | Jan. 25<br>Apr. 13 | 25.8 | 74.2 | 42.1 | 53.0 | 4.9 | .38 | 1.9 |
| 6 | (1) ethyl mercury oleate-oil emulsion 1-60<br>(2) ethyl mercury oleate-oil emulsion 1-60 | Jan. 25<br>Apr. 13 | 59.0 | 41.0 | 35.1 | 60.3 | 4.6 | .6 | 2.4 |
| 7 | (1) bordeaux 3-4-50 plus 1% oil<br>(2) lime-sulfur 1-40<br>(3) lime-sulfur 1-40<br>(4) lime-sulfur 1-50 | Jan. 25<br>Apr. 13<br>May 4<br>June 7 | 91.4 | 8.6 | 70.3 | 28.7 | 1.0 | 1.8 | 2.0 |
| 8* | (1) lime-sulfur 1-25 plus Kolofog 6-100<br>(2) lime-sulfur 1-40 plus Kolofog 3-100 | Jan. 25<br>Apr. 13 | 93.6 | 6.4 | 46.9 | 50.4 | 2.7 | 3.0 | 6.1 |
| 9 | (1) bordeaux 3-4-50 plus 1% oil<br>(2) lime-sulfur 1-40 plus Kolofog 4-100<br>(3) lime-sulfur 1-40 plus Kolofog 4-100 | Jan. 25<br>Apr. 13<br>May 4 | 93.7 | 6.3 | 74.6 | 25.2 | .2 | 2.7 | 3.9 |
| 10 | (1) bordeaux 3-4-50 plus 1% oil<br>(2) lime-sulfur 1-40<br>(3) lime-sulfur 1-40 | Jan. 25<br>Apr. 13<br>May 4 | 90.6 | 9.4 | 72.3 | 27.1 | .6 | 2.2 | 6.5 |
| 11 | (1) bordeaux 3-4-50 plus 1% oil<br>(2) oil emulsion 1-80 (approx. 1% oil) | Jan. 25<br>June 7 | 90.3 | 9.7 | 74.0 | 25.2 | .8 | 1.7 | 7.7 |

*Sprayed twice with bordeaux in 1933.

was least in the trees sprayed with the mercury emulsions, in the bordeaux plot receiving three post-bloom lime-sulfur sprays and in the unsprayed check trees. It was highest in Plots 2, 3 and 11. Two post-bloom applications of lime-sulfur after dormant bordeaux gave as good control of scales as a 1 per cent. oil emulsion applied in June.

CONCLUSIONS

The results of these spraying experiments show that scab can be effectively and economically controlled in most cases by spraying. Copper sprays have consistently given better control of the disease than the sulfur and mercury fungicides. Of the copper sprays thus far tested, home-made bordeaux mixture appears to be the most reliable and effective fungicide.

Basic copper sulfate has given as good control of scab as bordeaux mixture in the experiments of one season, but more data are necessary before it should be recommended for general use as a substitute for bordeaux. Bordol-Mulsion, a proprietary copper-oil combination sold as a substitute for home-made bordeaux-oil emulsion, is less effective than the latter for the control of scab. Both the basic copper sulfate and the Bordol-Mulsion leave less visible residue on the foliage and have given less trouble in promoting scale increase than bordeaux mixture.

If scab is expected to be severe, it is advisable to make two applications of bordeaux. The first spray should be applied at 3-3-50 concentration just before the spring growth starts. A suitable spreader, such as ½ per cent of oil as an emulsion, should be added and an attempt made to cover all the old scab lesions on the foliage. The second application should be made in the last of the bloom, using a 1½-1½-50 formula, with a suitable spreader added. This should be followed in June by an oil emulsion for scale control.

There is a marked reduction in the amount and severity of scab infection the year following this program, without further sprays being applied. Commercial control of scab may be obtained the second year by making a thorough dormant application of bordeaux mixture with spreader added, and omitting the bloom spray. This program is also recommended for the control of mild cases of scab infection in trees not sprayed the previous season for this disease.

When copper sprays are effectively applied for the control of scab, the amount and severity of melanose blemish on fruit and foliage is materially reduced.

Lime-sulfur sprays strengthened by adding Kolofog or wettable sulfur, and organic mercury emulsion may be used to prevent mild cases of scab from increasing, but these sprays give less reduction of melanose blemish than the copper sprays. In cases of mild infection, where the scale infestation is very heavy, and where it is desired to control red spider or rust mites on late fruit, one of these sprays should be applied instead of the bordeaux mixture.

When a dormant application of bordeaux mixture or bordeaux-oil emulsion has been made for the control of scab, and the scale infestation is slight, the control of these insects may be secured by the use of an oil emulsion spray in June, or by the application of three lime-sulfur sprays properly timed. The first of the lime-sulfur sprays should be applied in or shortly after the last of the bloom at 1-40 dilution, the second at four to six weeks later at the same strength, and the third may be applied whenever necessary for rust mite control. Dry lime-sulfur with bentonite sulfur added, may be substituted for the liquid lime-sulfur in this program.

Citrus Experiment Station.
Lake Alfred, Florida.
April 9, 1935.

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Question: Was that lime bluestone?

Mr. Ruehle: Yes, sir.

Question: I do not see any bordeaux followed by oil compared with bordeaux oil followed by oil. Have you made such comparisons?

Mr. Ruehle: We made them back in 1932, and received better control where we added the oil to the spray than where we added casein. So we stopped that.

Question: Did you use the basic copper three pounds to 100 gallons?

Mr. Ruehle: Yes.

Pres. Taylor: Senator W. T. Gary is here to invite you to Ocala for the Semi-Centennial and will deliver his invitation in person.

Senator Gary: I term myself a minister plenipotentiary and ambassador extraordinary, of the Chamber of Commerce of the great county of Marion, sometimes called "The Kingdom of the Sun." My understanding is that possibly a year ago an invitation was extended to this body by the Marion County Chamber of Commerce to have your fiftieth anniversary in the city of Ocala. The Society was organized there in 1887 and we think it is very appropriate they should come back home. I am representing also the business men and the mayor of Ocala. We give you a most hearty invitation to meet with us in 1937.

We are well equipped to take care of this convention. We have the Hotel Marion, seven stories high, right in the center of town. We can take care of you with the utmost ease. There are many places of civic interest. I will just mention briefly that we have Silver Springs, known to every Floridian. We have also just on one little circuit, Juniper Springs, nearly as beautiful, where something like $10,000 has been spent by the government last month. There is Silver Glen Spring, source of Lake George, and we are close to Salt Springs, that, though fifty miles from salt water, has shrimp, mullet and other salt-water fish in it. There is Blue Springs, just changed to Rainbow Springs. We believe we are geographically located so that we can bring a large number of your members here. We lie on two trunk line highways, No. 19, recently completed, starts up at Tallahassee; also on the Dixie Highway No. 2; but the main point is, we want you to come to Ocala in 1937. We have attained the name of "Convention City" and every man, woman and child will welcome you and we will give you a good time on the fiftieth anniversary of your birth.

Mr. O'Byrne: May I ask that the Golden Jubilee committee meet in this room immediately at the close of this morning's session?

(H. H. Hume, Dr. P. H. Rolfs and W. T. Garrett were added to the committee at this time.)

Mr. O'Byrne: I move that we select the city of Ocala for the 1937 meeting of the Florida State Horticultural Society and that at that time we celebrate the Golden Jubilee.

Mr. ------: Second the motion.

The motion was carried.

Senator Gary: Let me just thank these people for that splendid response to our invitation. Let me just add that Marion County will be particularly of interest to you engaged in citrus, because the Pineapple orange originated in Marion County on the homestead owned by the grandfather of Ex-Governor Martin. The fruit from this farm has taken first prize at the South Florida Fair on Pineapple oranges. There is something about the soil that is particularly adapted to it. Fruit from that grove has at least one year topped the American market at $12.00 per box. The Parson Brown originated right over the line in Sumter County, and it is of interest to mention that my father named the Parson Brown orange. We have lots of orange groves of high quality in Marion County.

## SOME FURTHER OBSERVATIONS ON MARGARODES IN CITRUS GROVES

**J. R. Watson, Gainesville**

Last year we called the attention of the Horticultural Society to the discovery of a scale insect on the roots of citrus trees, a species of margarodes or ground pears. We have been continuing the observations on the insect throughout the year, with the result that we have gathered a little more information that may be of interest to citrus growers.

As indicated last year, this insect is by no means confined to citrus, but is found on a number of plants and especially grasses. At the time of our observations last year, there was not as much grass in the infested groves as there was later in the season. Infestations of this scale insect during the summer showed it to be much more abundant on grass roots than on the roots of citrus, though

at all seasons of the year there was considerable numbers of the scales on citrus groves as well as on the grass. However, I believe at this time that we can confidently say that the scale prefers grass roots to citrus roots. This suggests a possible means of control. We have initiated experiments which have as their basis the destruction of the grass after the young crawlers have attached themselves, and hence would be unable to move to citrus roots on the destruction of the grass. By a systematic destruction of the grass at these favorable times, it may be possible to decidedly decrease their numbers.

There seemed to be two broods last year, although the young were not common in August when the second brood appeared. The mature female, when ready to lay eggs, forms a sort of nest, a pocket in the sand, which she lines with the waxy rods from her body. These eggs hatch into crawlers, which are active for a few days as in the case of other scale insects, then attach themselves. After this they are unable to move until they become mature. They grow to full size and the mature insect eats her way out of the hard shell covering. She is provided with two powerful claws which enable her to work her way through the soil to a favorable place in which to form her nest. After laying her eggs, the female dies.

The application of calcium cyanide to the soil last year did not seem to give any appreciable control of the scales. Many of the scales carried into the laboratory have been killed by ants and it is very likely they perform this same service in the groves.

Most of the infestations that have been found have been found in light, sandy soil, so it would appear that this is the favorite habitat of the insect. A few have been found in heavy soil, typical flat woods soil, but so far no heavy infestation has been found in such places.

## THE TREND OF CITRUS INSECT CONTROL IN FLORIDA

**J. R. Watson, Gainesville**

The first point I wish to make on the topic that has been assigned to me is that I do not believe any *set* schedule for spraying citrus trees for insects is practicable. There is too much variation in weather conditions, varieties of citrus, and in abundance of insects from year to year, even in neighboring groves. Several years ago entomologists of the Experiment Station, Plant Board and Bureau of Entomology, U. S. Department of Agriculture, put out a publication in which twelve common sprays for citrus pests were listed. No one of us thought for a minute of expecting any citrus grower to apply the whole dozen sprays during any one year; but some growers so understood it and were, very naturally, dismayed at the prospect.

As an illustration of the impracticability of recommending a hard and fast spray schedule let me recount a little experience we had this year. In October rust mite appeared in some of Mr. Thompson's plots at Lake Alfred. Now when rust mite appears one normally proceeds to dust with sulfur or spray with lime-sulfur. Mr. Thompson sprayed with lime-sulfur in strength varying from 1-40 to 1-60. No practical injury to anything except Hamlin oranges. A large proportion of these were severely burned even at a strength of 1-60. Several growers over the state reported the same experience.

Apparently we will have to leave lime-sulfur spray off Hamlin oranges at that time. Hamlins sprayed in July, even at a strength of 1:40 suffered no injury. Perhaps next year Mr. Thompson can tell you a little more definitely the latest date safe for lime-sulfur on Hamlins.

Another illustration. On the whole we regard an excellent time to apply a clean-up spray with an oil emulsion for scale insects and whiteflies to be late September or early October. But an oil emulsion delays to some extent the ripening of the fruit, and on an early fruit, such as Parson

Brown Oranges, and Satsumas, a spray at that time might be quite objectionable.

Because of these highly variable factors, a citrus grower who wants to obtain economical control of insects must be acquainted with his insects and must use his own good judgment as to when to spray or not to spray, and with what materials.

One of the most marked trends in insect control in Florida during the past year or two is the increased use of lime-sulfur spray as a control measure for rust mites and scale insects, thus killing two birds with one stone; or perhaps we had better say killing one bird and wounding another, since we are not yet in a position to advise attempts to quickly bring under control a heavy infestation of scale insects by the use of lime-sulfur. Since Mr. Thompson is to discuss this topic in detail we will not dwell upon it at this time except to emphasize the necessity of a thorough application if one is to expect much control of scale insects with lime-sulfur. A more thorough application than is often given for rust mite control.

Because of their dislike for dense shade, rust mites are not usually very abundant in the interior of a large densely leaved tree, and if such places are missed in spraying for rust mites not as much harm will be done as in the case of scale insects. Riding spraying, that is done from behind a tractor which does not stop from one end of the row to the other does not ordinarily give a sufficiently thorough coverage to be of much benefit in the control of Whitefly and Scale insects.

There has been considerable discussion as to the most desirable time of the year to apply an oil emulsion. In this connection we must keep in mind the development cycles of the insects we wish to control and also the growth flushes of citrus, since most oil emulsions are unsafe on very young fruit.

Whiteflies and scale insects are more easily killed in their earlier (i. e. younger) stages of growth; so, if practicable, insecticides should be applied at times when a large proportion of the insects are in their early stages.

Consider first Whiteflies. As is well known to all citrus growers, there are ordinarily three broods of these a year with the maximum number of adults flying in March, June, and from around the middle of August in this section to the first week or 10 days of September about Gainesville or in the Satsuma belt. From ten days to two weeks after these flights, most of the eggs will have hatched; so to catch Whiteflies in the early nymphal stages sprays would be indicated about April 1st, June and late September. Heretofore we have always considered the common citrus whitefly to be the much more important species. But during the past few years the cloudy winged whitefly has been increasing more rapidly and in some sections, as about Lake Alfred, is now the dominant species. The dates of its maximum emergence are later, about April 1st, early July, and October, delaying the most vulnerable spraying dates where this is the dominant species to mid April, mid July, and October.

Our scale insects have no such definite breeds as the whiteflies; crawlers may be found almost any time of the year although scarce during the colder month of the winter. Yet there are three periods when crawlers are more abundant than at other times. These times are March and early April, June or July, September and October. It is thus seen that the periods when Purple Scale can be most easily killed coincide quite closely with those for the control of the Citrus Whitefly—i. e. the first part of April, the latter part of June, and late September or October. But April is too early for a safe application of most oil emulsions. It is better to wait for the spring flush of growth to mature and the fruit to approach three-fourths of an inch in diameter—i. e. late May or June. Late June would catch the summer brood of the common citrus whitefly at its most vulnerable stage and mid July the cloudy winged. The rainy season is a difficult time to spray. One cannot start spraying in the morning until the dew has evaporated, or the rain in the afternoon on two afternoons out of three, and it is not safe to spray when the temperature is above 90 degrees. If one subtracts from the average summer day those hours when the trees are wet with dew or rain and those with temperatures above 90 degrees not much is left. Furthermore, in spite of some recent statements to the contrary, we are still convinced that the entomogenous fungi do a great deal towards the control of scale insects as well as whitefly and that there is always a good chance

that they will control the scales and whiteflies during the rainy season.

All things considered then it still seems to the writer that the best times for a thorough clean-up spray for scale insects and whiteflies is late September or October, or in late June and early July. In late September or early October the rainy season is usually over, making spraying more practical. The temperatures have commenced to moderate, and the early fall flush of growth to mature, making spraying safer; the season of best development of the entomogenous fungi is drawing to a close and the grower can better judge the necessity for a spray. To delay the applications of an oil emulsion too long will increase the danger of severe damage from a possible freeze.

### APHIDS

The green Citrus Aphid has not been very troublesome for several winters. Dry weather and this winter the December freeze have prevented the development of much new growth during the winter months or destroyed it. Starvation has reduced the number of the aphids during the winter to a very low per cent. There has been a considerable development this spring during the past few weeks—too late to be very serious. These are temporary factors in the control of Aphids. A more permanent one is the smaller proportion of young trees in the state as compared with 1924 and 1925 when aphids were at their worst. It is possible that we may never again experience the heavy damage of those years.

We still find growers applying aphicides too late to do much good. Aphids do their maximum damage in the very early stages of the development of the new growth. When the leaves are half grown or more the aphid season for that twig is drawing to a close and the insects will soon leave even if no measures are taken.

We are pleased to report that in spite of the scarcity of food, the Chinese Lady Beetles, Leis, have survived the winter in northern Orange County where they have become well established and have given commercial control for several years.

Some people advise blossom spraying, but from the insect point of view it is difficult to see the necessity of any such spray under all conditions. Of course, late fruit where the previous crop is still on the trees at blossoming time might need a spray of lime sulphur for rust mites or one for red spiders. Both of these pests are more apt to occur a little later in the season than at blooming time. Aphids may be fairly abundant in a grove at blooming time, but if the bloom is at all uniform in its appearance, that is too late to combat aphids successfully.

The only other insect that might require blossom spraying would be thrips. They have been very abundant, both this year and last, at this time but the peak infestation came after most of the trees were through blooming. Anyhow, with the current prices for fruit it will scarcely pay to spray for thrips except under unusual conditions; namely, heavy infestation of thrips and light bloom. By heavy infestation, we would mean an average of at least a dozen per blossom. The most economical way to control thrips is to keep the grove free of blossoming weeds during the winter. On the whole, we see little merit in blossom spraying as applied regularly.

### AIRPLANE DUSTING

Dusting with airplanes is, so to speak, "in the air." This method of applying insecticides has made more progress in the vegetable areas of the lower East Coast than it has in citrus groves. However, airplane dusting has certain advantages and certain disadvantages. With proper weather conditions and the absence of wind, it can lay down a dust which covers the entire grove very effectively. The larger the area dusted at any one time, the less danger that the dust will be too quickly dissipated by wind. This and the rapidity with which it is applied, make of it a satisfactory method of application under limited conditions.

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Question: May I ask about aphis on fruit when it is very small. Does that injure the fruit permanently in appearance?

Mr. Watson: We have found that when as big as a pea the fruit will stand a surprising amount

of punishment from aphis and still mature. At first we were scared about the bumps they put on young fruit, but we found they disappeared before the fruit matured.

Mr. Thatcher made the following announcement:

Mr. Thacher (displaying large silver cup): In order to stimulate the enlistment of members in the Horticultural Society, the McKee Jungle Gardens, through Mr. Sexton, manager, is putting up this cup, to be given to the community enrolling the largest number of members in the Horticultural Society. It will be awarded at the closing session and will be kept in the community where it is won for a few months, for display, and will be then returned to the custody of the secretary, for competition in succeeding years. Any community winning it for three successive years will retain it as a trophy. I trust the presentation of this cup will stimulate membership in the Hortlcultural Society, so that it can expand its usefulness in our State. I think any of you will be proud to carry this cup home.

Report of the Legislative Committee was made by Mr. C. I. Brooks:

Mr. Brooks: Your legislative committee believes that it has had some of the most important bills presented to it for action and for your action that it has ever had. The committee appointed was not all present, nevertheless, the members who were present gave it a great deal of long and careful attention and we present to you as a committee these resolutions:

Resolution No. 1 (regarding research work by Florida Citrus Commission) read.

Mr. Brooks: The committee would like to have your action on this resolution.

Mr. ------: I move the adoption of this resolution.

Mr. ------: I second the motion.

Motion carried.

Resolution No. 2 (asking appropriation of $16,018.00 for State Plant Board) read.

Mr. ------: I move the adoption of this resolution.

Mr. ------: I second the motion.

Motion carried.

Mr. Brooks: I think all of you present probably know from newspaper articles there have been various bills introduced referring to the citrus industry as a whole and various phases of it. The bills are probably known to you and for that reason we have included them all in one bill:

Resolution No. 3, endorsing various citrus bills, read.

Mr. Brooks: It was brought out in our committee meeting that no set of bills has ever had the support of the industry as a whole and it is believed that something like 90 per cent. or even more are solidly behind these bills. Whether the reason is that we have all been driven so hard and are all down so low, at any rate we are glad to report that the citrus industry is behind these bills.

Mr. ------: I move the adoption of this resolution.

Mr. ------: I second the motion.

Motion carried.

Resolution No. 4, asking appropriation of $35,000 for the Citrus Experiment Station, read.

Mr. ------: I move the adoption of this resolution.

Mr. ------: I second the motion.

Motion carried.

Mr. Brooks began to read Resolution No. 5 (regarding water levels) when he was interrupted:

Question: Might it not be in order that we send wires to Tallahassee that our organization has passed certain resolutions to be received during the hearing up there today?

President Taylor: If it is the request of the Society, I will ask our legislative committee to transmit these resolutions to the committees of the House and Senate.

Mr. Brooks concluded the reading of the resolution.

Mr. ------: I move the adoption of this resolution.

Mr. ------: I second the motion.

Mr. Barrow: It says to make investigation; does it say to take any further action?

Mr. Brooks: We feel, if the Governor made investigation, he would be led to request the ac-

tion. We believe his determination of the fact would lead him to action.

Question: Do you not think it would be wise to incorporate in that resolution a request that he take any action which seems necessary?

Mr. Brooks: Do you wish to add this to the resolution?

Answer: Yes.

Question: Do you also think it would be well to add the words "to conserve the best interests of the citrus industry"?

Answer: I believe the introduction covers that. Please repeat the question.

Mr. Barrow: I merely asked the question if the purpose of the resolution was simply for the purpose of making an investigation and I would like to suggest that if the governor finds any drainage of fresh water lakes deleterious to the citrus interests, he be asked to put a stop to it.

Mr. Holland: This suggestion was brought over here from Winter Haven. We have felt for years there has been an excessive amount of drainage going on over the state. We are in sympathy with any constructive drainage proposition, but we are not in sympathy with unregulated and promiscuous digging of ditches, canals, etc., when the sole idea is taking water out of the country without storing up any for droughts, freezes, etc. We have felt the state should have some control, centered in the hands of the conservation committee, regulating these things and preventing overdraining of land to the detriment of the citrus interests. We had no thought in mind at all to go into the Everglades and Oklawaha districts, where water control is satisfactory at the present time. We frankly felt that some regulation would be desirable. However, at the legislative committee meeting last night, they were not unanimous, and the resolution was drawn up as read. We like your amendment and will be glad to have the governor make the investigation and then, if he sees fit, to provide proper legislation in regard to this water control.

Amendment as follows accepted by the legislative committee and incorporated into the resolution:

"That the Governor be requested to take such action as he may think necessary to carry out proper control measures."

The amended resolution was read.

Mr. ------: I move the adoption of the amended resolution.

Mr. ------: I second the motion.

Motion carried.

Mr. Brooks: The committee appreciates the action of this body. We feel that heretofore there have been so many diverse opinions that in this particular instance we are gratified that the action of this legislative committee and this body is unanimous. This is only the start of this fight. While we have not spoken to Senator Taylor about it, it is the unanimous opinion of our committee that he should go to Tallahassee and endeavor to fight through these bills and resolutions. Will some one make a motion that Senator Taylor be authorized?

Mr. Holland: I so move.

Mr. ------: I second the motion and would like to have him carry the word that there was not a single dissenting vote.

Motion carried.

President Taylor: I want to say in this connection, it is not a difficult matter to go to Tallahassee, although it is a good long trip, and you can try and work hard, but you know you have got 133 people to deal with, besides a lot of outsiders and you can't always get the things done you want, but I assure you I will do my best. I am personally interested in the passage of citrus legislation and these other matters, as well. I will undoubtedly have to go up there the first of next week anyway, and appreciate the confidence placed in me by this Society and will do the best work I can to get this legislation enacted into law.

Here Mr. O'Byrne took the chair.

Mr. Lord: Mr. Chairman, the reason I am bringing this to the attention of the Society now is that so many of you are liable to go back this afternoon before the business session will start and I have been asked to read this signed statement by a number of members of the Society.

Here the speaker read a request that at the next meeting of the organization one day be set

aside for the consideration of nitrogen, potash and phosphoric acid.

The matter was referred to the executive committee.

Dr. F. C. Dorment, of St. Petersburg, was called on for his paper on "Playing with Citrus Fruits," but was not present.

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# MISCELLANEOUS RESULTS OBTAINED BY THE FRUIT INSECT INVESTIGATIONS DIVISION OF THE BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE ORLANDO, FLORIDA

**W. W. Yothers, Entomologist***
**Bureau of Entomology and Plant Quarantine**
**U. S. Department of Agriculture, Orlando**

### RESULTS FROM ONE SPRAY APPLICATION FOR RUST MITE CONTROL ON PARSON BROWNS

As may be generally remembered, the rust mites were not very abundant last season until in June. This was especially the case in the little grove of Parson Brown oranges where these experiments were conducted. However, on June 8 there were enough mites present to demand attention, and an application of lime-sulfur, 1 to 50, to which was added varying amounts of wettable sulfur ranging from 5 to 10 pounds, was made. The spray was thoroughly applied.

The single application on all plots prevented practically all rust-mite injury until November 14-21 when the fruit was harvested. The fruit reached a state of legal maturity October 15, and at that time there were quite a number of rust mites present, and these had increased greatly by November 15. If the fruit had remained on the trees two weeks longer it would have been necessary to spray again to prevent the entire crop from being turned into a golden grade.

This experiment, although carried on during a year when the rust mite was not a very serious problem, indicates that perhaps citrus growers can produce a crop of early oranges, free from rust mite attack, with only one application of spray.

*Retired May 31, 1935.

### CONTROL OF CITRUS PESTS WHEN BORDEAUX IS USED FOR THE PREVENTION OF PLANT DISEASES

It is generally known to citrus growers in Florida that practically all pests attacking citrus trees (scale insects, whiteflies, mealybugs, red spiders, and rust mites) are attacked by several species of entomogenous fungi. These species attacking scale insects and whiteflies are so effective that spraying with oil emulsion or the sulfur sprays is resorted to only occasionally, when, due to adverse weather conditions, the fungi do not bring about commercial control. When Bordeaux is used to prevent melanose and other citrus diseases, it not only controls the plant disease but likewise prevents the activity of the beneficial fungi. The insects, without these natural checks, increase at an alarming rate.

In the past much experimental work has been done to control insect pests when normal activity of the beneficial fungi has been interfered with by Bordeaux. This past season we carried on some additional work, using Bordeaux combined with wettable sulfur. On March 22 a block of large sweet-seedlings were sprayed with Bordeaux, 3-4-50, to which was added 10 pounds of wettable sulfur. There was the usual infestation of purple scales present at the time of the spraying. By July 5 there was only a slight increase in purple scale population, and this was most effectively controlled at that time by a most thor-

ough application of lime-sulfur, 1 to 50, to which was added 5 pounds of wettable sulfur. This application was given at the time when the second hatch of the purple scale eggs was taking place, and therefore when the greatest number of the crawling young and first larval stage were present. Up to the present time no unusual abundance of scale insects had developed. While the above results have been obtained in only one season, we believe they are so promising that those growers who are experimentally inclined would do well to try the Bordeaux-wettable sulfur combination. In case this is done, we would suggest using only 5 to 6 pounds of wettable sulfur per 50 gallons.*

Orlando, Florida, March 8, 1935.

*"The extensive use of half-strength Bordeaux combined with several wettable Sulphurs has given most satisfactory results during the Spring of 1935. Melanose, in every instance, has been prevented almost entirely. Rust mites have not come back for nearly three months after the use of the combination and the scale insects have not increased much more than where no spraying has been given."

## USE OF AIRPLANES IN AGRICULTURE

**J. D. Reed, Tallulah, La.**

After sitting here listening to the very splendidly prepared and very enjoyable and instructive papers, I feel hesitant to appear before this audience to give an extemporaneous talk on the subject of the use of airplanes in agriculture.

We have always looked upon the airplane as an instrument of warfare and of course, following the war, there were a great many boys who turned to flying.

Back in 1922, near Dayton, Ohio, a number of catalpa groves were infested with catalpa worms and someone conceived the idea of combating it with airplanes. They proceeded to try to fly over these groves with sprays, but they could not get near enough to the trees and when they put out the poison it went into the next fields and the worms went on and ate up the catalpas. But it was the birth of an idea and Dr. Coad of Tallulah, La., started to work with airplanes for spreading calcium arsenate for boll weevil control and he made great progress in determining the exact amount per acre and how to distribute it so there would not be an overcharge in one place and shortage in another. Geo. Post had a forced landing at Tallulah and found out what was being done. He came out the following year with two engineers working with Dr. Coad and in 1924 we had our first commercial operations and in 1925 there were a fleet of 18 airplanes in the south.

Of course, using airplanes to farm with is an idea which most people are inclined to look at in astonishment, but it is logical that in their use we double the power of a man with horsepower. We do our dusting with 250 H. P. engines and distribute it at the rate of 100 miles an hour. We were wondering why we were able to get greater adhesion dusting in the airplane than with ground equipment dusting which was almost equivalent to throwing the poison away. Dr. Coad found that the dust particles were magnetized, so that there was electrical attraction between the particles and the surface of the cotton plants, but that this did not occur in the dust spread by the ground machines.

It seems like a good theory and has worked out in practice as demonstrated by the better results obtained from using the method over the ground methods. The speed, of course, is more rapid than any other means of making the application. The distribution is controlled by the pilot, just under his gas throttle and he flies low about 100 miles an hour opening the throttle just as he passes the border line of trees.

He can control the distribution just as he wants to. It demands a good deal of skill, but flying is just an instance in this operation. We have put out three, four or five pounds to an acre accurately. Sometimes when the dusting is being

done, some of the boys will say they do not think they are putting out quite the acreage they think they are, and they find they are right.

We have carried this work on since 1925 comcercially and are still operating for the first people for whom we operated. Since that time, we have operated in Georgia, Texas, Mexico and for four years in South America. In fact until the revolutions broke out and things got pretty hot, and we came on home. Down in Peru where they plant their grain with oxen they plant their cotton with spades and then we went down and taught them to farm with airplanes. We were operating in the two valleys the first two years, after that in the seven cotton districts in Peru. After the revolution we sold our operation and the work is still being carried on there. Dusting with airplanes is successful. It meets many requirements. You can go over any kind of boggy or rough place. You do it with speed, and without interrupting operations on the farm. We have been operating this year in the truck district south of here in the neighborhood of Fort Lauderdale and am glad to say that all of the places where we have operated have requested our return and are wanting contracts for the coming year.

You will notice when you watch the demonstration this afternoon that as the poison leaves the ship, it comes out in a big gust which will swirl through the trees, dusting it through them as the ship passes. The bottom of the leaves will be covered as well as the tops. We prepare protective treatment for your groves. I know you will have some insect pests here and I think you realize they are here. I think we get used to them and perhaps negligent. It makes me think of the man who was born in Mississippi, moved over to Arkansas, then to Oklahoma, then to Texas and finally to West Texas to die. He went to the lower regions but the change was so gradual, he never noticed the difference. I think our insect problems come to us gradually. We get to shipping some rusty oranges and accept the matter, the change has come to us gradually, but I tell you I believe you are going to have to really get after your insects as they have in the cotton belts in Alabama where they are dusting with arsenicals, and we hope that when it comes to this protective work, you will find use for the airplanes.

## THE CONTROL OF PURPLE SCALE AND RUST MITES WITH LIME-SULFUR SOLUTION

**W. L. Thompson, Lake Alfred, Florida**

During the years of 1930, 1931, and 1932 some preliminary experiments were conducted to determine whether purple scale could be controlled with lime-sulfur solution. The results of those experiments showed that the scale insect population was reduced with three to four applications of lime-sulfur made at four to six weeks intervals. Earlier studies by various workers had shown the lime-sulfur was toxic to the young stages of scale insects, but little or no experimental work had been published in Florida as to the practicability of that material as a scalescide. In Professor J. R. Watson's* Insect Bulletin, he states that all stages of scale insects may be found at almost any time of the year, yet there are three periods when crawlers are more abundant than at other times. They are in March or ealy April, June or July and September or October. It is in those periods when scale crawlers are most abundant that the maximum control can be obtained. Lime-sulfur is not so effective as an oil emulsion with the older stages of scale insects, therefore, it is important to apply it as near the peak of the crawler stage as possible. If for some reason it is not practical to apply the spray in late March or early April, purple scale can still be reduced by later applications but the percentage of kill will likely be lower.

*Entomologist, Florida Agricultural Experiment Station.

During the past two years experiments with lime-sulfur solutions have been conducted in various programs as a means of controlling purple scale, rust mites, and whitefly. The degree of scale insect infestation, or the potential infestation, determined the type of program to be used. Three rather distinct programs were followed: first, when the purple scale infestation was light the spray solutions were applied only when needed for rust mite control, with purple scale control incidental; second, when there was a medium to heavy infestation of purple scale the spray solutions were applied for scale control with rust mite control incidental; third, when Bordeaux mixture or some other copper compound was applied for fungi control the insecticides were applied as soon as practical after the fungicidal sprays.

The method used for taking data in the lime-sulfur experiments presented in this paper was as follows: counts of purple scale were made from each plot before the first application of spray, and another from six weeks to a longer period of time after the last application. Either ten or twenty leaves were picked at random from ten or more trees, depending on the size of the plot. Usually 200 leaves were picked. The leaves were put in paper bags and placed in the refrigerator until counted. Before counting the scale insects the leaves were mixed, replaced in the paper bag and drawn out at random when the count was being made. A greater number of living scale insects were counted when the infestation was heavy than when it was light. In some experiments where the infestation was medium to heavy, 500 living scale were counted from each plot, but in others where the infestation was light all the scales were counted from 100 to 200 leaves or until a good average was obtained.

When rust mite records were taken, counts were made from trees with at least two buffer rows on each side. Usually 100 fields were examined in each plot. The lense field was five-eights of an inch in diameter. Periodical inspection of mites were made throughout the season.

During 1933 the first type of program, that is, when the sprays were applied primarily for rust mite control with purple scale control incidental, was conducted in a ten-year-old grapefruit grove. The trees averaged approximately 12 feet in height, with a limb spread of 14 feet. The trees in the sprayed plots received an average of 3.6 gallons of spray material per tree, and those in the dusted plots received approximately three-fourths of a pound of sulfur dust per tree.

The results of counts of purple scale before the first application of the insecticides showed a range of 1.19 to 2.41 living scale per leaf which was considered a light infestation. Seven plots received various sulfur solutions such as liquid lime-sulfur 1-50, liquid lime-sulfur 1-50 plus iron sulfate 2 pounds per 100 gallons, dry lime-sulfur 4 and 6 pounds per 100 gallons, respectively, dry lime-sulfur plus Kolofog 6 and 12 pounds per 100 gallons, respectively. Kolofog is a bentonite sulfur containing 30 per cent sulfur. Three plots were dusted with sulfur dust, two of them with Kolodust, a 70 per cent bentonite sulfur dust, and the other plat received an ordinary 95 per cent sulfur dust.

The spray applications were made May 8, July 28, and October 30. The sulfur dusts were applied on the same dates but the plots receiving bentonite sulfur had an additional application on November 21.

The results of a count of purple scale six weeks after the last application of sprays showed a decrease of 3 to 67 per cent of living scale per leaf in all plots receiving some form of lime-sulfur. There was an increase of 23 to 68 per cent. of living scale per leaf in all plots receiving a sulfur dust and those receiving bentonite sulfur as a spray. These results would indicate that sulfur applied in the form of lime-sulfur is more effective for scale control than when applied as ordinary sulfur. The plot receiving 12 pounds of bentonite sulfur per 100 gallons had almost as much sulfur in the solution as the lime-sulfur 1-50.

During the period the experiment was run, which was from May 8 until February 1, eight detailed inspections for rust mites were made. In the sprayed plots the average infested field ranged from 3.3 to 7.5 per cent. for the season and in the dusted plots the infested fields ranged from 12 to 17 per cent. When the last counts

were made, February 1, two to 14 per cent. of the fields were infested in the sprayed plots and 16 to 68 per cent. in the dusted ones. Although no accurate count of marked fruit was made, there was less than 2 per cent. of russet fruits in the sprayed plots and a much higher percentage in the dusted ones. Practically no bright fruits were observed in the check plot for the season.

Dry lime-sulfur 5 pounds plus Kolofog 2 pounds per 100 gallons, dry lime-sulfur 6 pounds per 100 gallons, and liquid lime-sulfur 1-50 gave the best results as combined purple scale and rust mite sprays. Liquid lime-sulfur 1-50 plus iron sulfate had the lowest average per cent. of infested fields for the season.

During 1934 a similar experiment was carried on in a Valencia orange grove. The trees averaged 15 feet in height with a limb spread of 16 feet. Approximately 6.5 gallons of spray material were applied per tree. There were ten sprayed plots and two dusted ones. The plots were five rows wide and six to seven rows long. The counts of rust mites were made from the center rows. Three applications of spray materials were made on the following respective dates: May 1, July 6, and October 20. The various combinations of sprays were: straight dry lime-sulfur, liquid lime-sulfur, dry lime-sulfur plus Kolofog, liquid lime-sulfur plus Kolofog, liquid lime-sulfur plus wettable sulfur, and soluble sulfur plus Kolofog.

When the first application of sprays was made, 18 to 35 per cent. of the fields were infested with rust mites. During the period between the first and second applications of sprays, which was approximately 67 days, 28.84 inches of rain fell. The plots receiving dry lime-sulfur 5 pounds, Kolofog 2 pounds, and liquid lime-sulfur 1-40 plus 2 pounds of Kolofog per 100 gallons, respectively, had decidedly less mites at the end of that period than the other plots; the average infested fields for those plots was 15 per cent. The liquid lime-sulfur 1-40 plus wettable sulfur 2 pounds per 100 gallons did not show up quite so well but was better than those plots receiving the straight liquid lime-sulfur. Soluble sulfur plus Kolofog gave very unsatisfactory results; in those two plots 59 per cent. of the fields were infested.

There was a period of 105 days between the second and third applications. During that period 18.58 inches of rain fell. Again the plots receiving liquid lime-sulfur plus Kolofog and those reeiving lime-sulfur plus wettable sulfur had less infested fields than the plots receiving the straight liquid or the ones receiving soluble sulfur plus Kolofog.

The period was 127 days between the third application, October 20, and the date of the last counts, February 25. At that date, there was a range of 5 to 49 per cent. of the fields infested on trees in the plots receiving lime-sulfur plus the wettable sulfurs or an average of 20 per cent. infested fields for all those plots compared with an average of 57 per cent. infested fields on two plots receiving a straight lime-sulfur solution.

The liquid lime-sulfur was applied at a 1-40 strength for the first application, whether applied alone or with the addition of 2 pounds of the wettable sulfur per 100 gallons. For the second, or July application, the liquid lime-sulfur was reduced to 1-60, and 4 pounds of the wettable sulfurs added. The October sprays were applied at a 1-50 strength plus 3 pounds of wettable sulfur per 100 gallons. The dry lime-sulfur was applied at 5 pounds per 100 gallons plus 2 pounds of Kolofog throughout the experiment.

A week after the July application some foliage burn was observed on trees that had been sprayed with liquid lime-sulfur alone or plus the wettable sulfurs, but no burn was observed on trees receiving dry lime-sulfur.

Counts of scale insects were not made in this grove. The infestation was light when the experiment was started with no apparent increase in December.

The second type of program was followed when there was a medium to heavy infestation of purple scale. The lime-sulfur sprays were applied for the control of scale insects with rust mite control incidental. This program was conducted for three successive years, and for two years in the same grove. In that grove each plot was divided so that one-half received three applications

and the other half, four. In 1932 four different combinations of lime-sulfur were used, lime-sulfur 1-40, lime-sulfur 1-40 plus 5 pounds of hydrated lime per 100 gallons, lime-sulfur 1-40 plus iron sulfate and lime-sulfur 1-40 plus three-eighths of one per cent. Penetrol. The materials were applied at six-week intervals, May 12, June 21, and August 3, and the half plots receiving the fourth application were sprayed September 30. There was a reduction of purple scale in all sprayed plots and an increase in the unsprayed plot but the fourth application gave very little control. Rust mites were at a minimum during the summer in all the sprayed plots. Those plots receiving the last spray in August were dusted for mites in early December, but the ones sprayed September 30 needed no further attention. The fruit was picked in April. There was much less sooty mould on the sprayed trees then on those in the check plot. A count of young whitefly larvae ten days after the September application showed a 48 per cent. decrease as compared with the check.

In 1933 the experiment was conducted in much the same way except that the first application was made April 5 compared with May 12 in 1932. The other applications were made May 11, July 7, and the half plots receiving the fourth application were sprayed August 16. This change was made because a higher per cent. of purple scale crawlers is usually present in early April than in May. The addition of Penetrol and iron sulfate to the lime-sulfur was omitted and wettable sulfur 5 pounds per 100 gallons was added to a lime-sulfur 1-50 for one plot and Koloform, a 70 per cent. bentonite sulfur, at the rate of 7½ pounds per 100 gallons was sprayed on the other plot. The other two plots received a lime-sulfur 1-40 and lime-sulfur 1-40 plus hydrated lime 5 pounds per 100 gallons. The result of this experiment showed 20 to 27 per cent less living purple scale per leaf in the plots receiving four applications than in those receiving three. The reduction in living scale was much greater in all lots receiving lime-sulfur than in 1932. Lime-sulfur plus wettable sulfur gave the most satisfactory results as a combined spray for purple scale, whitefly, and rust mites. Koloform gave the most unsatisfactory results for scale and whitefly control. These results again indicated that better control can be obtained with a lime-sulfur solution than with a wettable sulfur applied alone. The last application of sprays made August 16 gave rust mite control until late December.

The third program was the control of scale insects and rust mites after an application of Bordeaux mixture or some other copper compound for melanose or citrus scab control. The Departments of Pathology and Entomology co-operated in some of those experiments; namely, the melanose one at Babson Park and the citrus scab experiment at Bradenton. The experiments at Lake Alfred were conducted by the speaker. All th Bordeaux mixture experiments were conducted in grapefruit groves.

According to unpublished data of W. A. Kuntz* and Doctor G. D. Ruehle*, the opportune time to protect young fruit from melanose infection is usually during the first half of April or when the fruits are about the size of a garden pea. Although we have found that the first half of April is also an opportune time to apply lime-sufur for purple scale control, later aplications reduced or held in check these insects.

The experiments at Babson Park have been conducted for two successive years. In 1933 there were seven plots in the experiment including the unsprayed plot or check. Three applications of spray were made at intervals of two weeks; the first one was made April 4. One plot received copper ammonium silicate and another, Bordeaux mixture 1½-2-50. Two applications of lime-sulfur 1-40 followed in each plot at two-week intervals. There was a reduction of 66.6 per cent. of living scale per leaf where lime-sulfur followed Bordeaux mixture and 79.7 where it followed copper ammonium silicate. One plot received three applications of lime-sulfur 1-40 and another plot received lime-sulfur 1-40 plus Kolofog. The reduction in living scale per leaf was 93.9 and 92.8, respectively. Two plots sprayed with a colloidal sulfur at the rate of one gallon and two gallons, respectively, per 100 gallons of

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water showed a reduction of 76.5 and 73.5 per cent. as compared with a reduction of 61.8 per cent. in the untreated plot.

The experiments of 1934 were conducted in much the same manner as in 1933, except that more tests were made with different materials. One plot was sprayed with Bordeaux 3-4-50 plus one per cent oil emulsion, February 6. The other plots received the first application of sprays April 10 and 11, the second on April 24, and the third, May 7, with the exception of those plots receiving an oil emulsion which were not sprayed until June 1.

The scale control was practically the same in plots sprayed with Bordeaux 1½-2-50 followed in one plot with two applications of lime-sulfur 1-40 and in another with one application of one per cent. oil emulsion. Two applications of lime-sulfur 1-40 applied April 24 and May 7, respectively, gave a greater reduction than one application of oil emulsion following a dormant Bordeaux 3-4-50 plus one per cent. oil emulsion. Three applications of lime-sulfur 1-40 plus Kolofog, 4 pounds per 100 gallons, gave a much greater reduction in scale than three applications of straight lime-sulfur 1-40. There was a marked reduction in purple scale in a plot sprayed with basic copper sulfate compared with one receiving Bordeaux 1½-2-50, both plots receiving two later sprays of lime-sulfur 1-40. The greatest per cent. of decrease in purple scale resulted in a plot sprayed with basic copper sulfate plus one per cent. oil on April 10 and followed with oil emulsion in June. A proprietary copper and oil emulsion applied April 10, followed by oil emulsion in June, gave results nearly equal to the basic copper and oil combination. See Table I for detailed results.

In the citrus scab experiments at Bradenton the majority of plots were sprayed with dormant Bordeaux 3-4-50. Eight plots received a Bordeaux plus one per cent. oil and two others were sprayed with Bordeaux plus calcium caseinate. The applications were made January 18 and 19. The per cent. of increase of purple scale was greater where one application of a one per cent. oil emulsion followed a dormant Bordeaux-oil than where it was followed with three applications of either straight lime-sulfur or lime-sulfur supplemented with a wettable sulfur. There was little difference in the control of scale insects in plots that received a dormant Bordeaux plus one per cent. oil than plots sprayed with dormant Bordeaux plus calcium caseinate when followed with comparable scalecides. The results also show that the per cent. of increase of purple scale was not so great in plots that received the first lime-sulfur application, April 11, as in a plot receiving the first application on May 11. In this experiment the greatest reduction in scale was obtained in a plot receiving dry lime-sulfur 5 pounds plus Kolofog 2 pounds, following a dormant Bordeaux-oil. Liquid lime-sulfur plus wettable sulfur gave almost equally as good results. Although purple scale increased in all the plots but two, there was not so much increase, except in one plot, as in the check. See Table II for detailed results.

Unfortunately a crop of fruit did not set in this grove, consequently no rust mite records were taken.

Experiments carried on in a grapefruit grove near Lake Alfred during 1934 were for the purpose of testing various sulfur sprays for the control of purple scale and rust mites after an application of Bordeaux mixture for melanose control. Each plot was five rows wide and nine rows long. Eleven plots were sprayed with Bordeaux mixture, one other plot received dry lime-sulfur plus Kolofog, and one received no treatment. In the Bordeaux plots five rows were sprayed with Bordeaux 1½-1½-50 and four rows with Bordeaux 3-3-50. Calcium caseinate was used as a spreader. In nine of the Bordeaux plots sulfur sprays followed; in one plot, a one per cent. oil emulsion and sulfur dust followed, and in the other plot only sulfur dust. The check received no treatment.

The Bordeaux mixture was applied April 9. The sulfur sprays were applied April 30, June 8, and August 6. The August spray was applied when needed for rust mite control. The sulfur sprays tested were: liquid lime-sulfur, liquid lime-sulfur plus wettable sulfur, liquid lime-sulfur

plus Kolofog, dry lime-sulfur, dry lime-sulfur plus Kolofog, and soda sulfur, or soluble sulfur, plus Kolofog. The first application of liquid lime-sulfur was made at a 1-40 dilution, the second 1-50, and the third 1-60. In sprays where lime-sulfur was supplemented with either wettable sulfur or Kolofog, the amount of these materials was increased when the concentration of lime-sulfur was decreased. For instance, the first application in one plot was lime-sulfur 1-40 plus wettable sulfur 2 pounds per 100 gallons; the second application, lime-sulfur 1-50 plus 3 pounds of wettable sulfur; and the third application, lime-sulfur 1-60 plus 4 pounds of wettable sulfur. The Kolofog was used in the same proportions with liquid lime-sulfur. Dry lime-sulfur 5 pounds plus Kolofog 2 pounds per 100 gallons was used in one plot throughout the season.

The results of these experiments show that in five out of six plots there was a higher number of living scale per leaf where Bordeaux 3-3-50 was used than in those plots receiving Bordeaux

TABLE I

MELANOSE AND PURPLE SCALE EXPERIMENT
BABSON PARK, FLORIDA
1934

| Materials Used | Dates of Application | Av. No. Living Scale per Leaf | | Per cent. Increase or Decrease of Living Scale |
|---|---|---|---|---|
| | | Before Treatment | After Treatment | |
| Bordeaux 1½-2-50 plus Calcium caseinate<br>Liquid lime-sulfur 1-40<br>Liquid lime-sulfur 1-40 | Apr. 9<br>Apr. 24<br>May 7 | 4.89 | 9.25 | + 89.1 |
| Bordeaux 1½-2-50 plus Calcium caseinate<br>Oil emulsion (1% oil) | Apr. 9<br>May 7 | 4.68 | 8.76 | + 87.1 |
| Bordeaux 3-4-50 plus 1% oil<br>Liquid lime-sulfur 1-40<br>Liquid lime-sulfur 1-40 | Feb. 6<br>Apr. 24<br>June 1 | 2.58 | 2.98 | + 15.5 |
| Bordeaux 3-4-50 plus 1% oil<br>Oil emulsion (1% oil) | Feb. 6<br>June 1 | 5.00 | 6.66 | + 33.2 |
| Lime-sulfur 1-40, Kolofog 4 lbs. per 100 gals.<br>Lime-sulfur 1-40, Kolofog 4 lbs. per 100 gals.<br>Lime-sulfur 1-40, Kolofog 4 lbs. per 100 gals. | Apr. 10<br>Apr. 24<br>May 7 | 2.45 | 2.14 | − 12.8 |
| Basic copper sulfate plus Calcium caseinate<br>Lime-sulfur 1-40<br>Lime-sulfur 1-40 | Apr. 9<br>Apr. 24<br>May 7 | 5.86 | 4.16 | − 29.0 |
| Basic copper sulfate plus 1% oil plus Calcium caseinate<br>Oil emulsion (1% oil) | Apr. 10<br>June 1 | 6.30 | 1.85 | − 70.6 |
| Schnarr's Bordol-Mulsion plus Calcium caseinate<br>Oil emulsion (1% oil) | Apr. 10<br>June 1 | 7.11 | 2.32 | − 67.3 |
| Bordeaux 3-4-50 plus Calcium caseinate<br>Oil emulsion (1% oil) | Apr. 10<br>June 1 | 8.26 | 14.70 | + 77.9 |
| Check | | 7.81 | 9.34 | + 19.7 |

## TABLE II

CITRUS SCAB AND PURPLE SCALE EXPERIMENT
BRADENTON, FLORIDA
1934

| Materials Used | Dates of Applications | Av. No. Living Scale per Leaf | | Per cent. Increase or Decrease of Living Scale |
|---|---|---|---|---|
| | | Before Treatment | After Treatment | |
| Check | | 1.4 | 7.1 | + 407.0 |
| Bordeaux 3-4-50, oil emulsion (1% oil)<br>Oil emulsion (1% oil) | Jan. 18<br>June 26 | .54 | 2.8 | + 418.5 |
| Bordeaux 3-4-50, oil emulsion (1% oil)<br>Lime-sulfur 1-40<br>Lime-sulfur 1-50<br>Lime-sulfur 1-60 plus Kolofog 3 lbs. per 100 gals. | Jan. 18<br>May 11<br>June 25<br>Aug. 6 | .61 | 2.6 | + 326.2 |
| Bordeaux 3-4-50, oil emulsion (1% oil)<br>Lime-sulfur 1-40<br>Lime-sulfur 1-40<br>Lime-sulfur 1-50 | Jan. 18<br>Apr. 11<br>May 11<br>June 25 | 1.16 | 1.5 | + 29.3 |
| Bordeaux 3-4-50, oil emulsion (1% oil)<br>Lime-sulfur 1-40<br>Lime-sulfur 1-50, wettable sulfur 4 lbs. per 100 gals.<br>Lime-sulfur 1-60, wettable sulfur 4 lbs. per 100 gals. | Jan. 19<br>Apr. 11<br>May 11<br>June 25 | 1.2 | 1.2 | 0.0 |
| Bordeaux 3-4-50, oil emulsion (1% oil)<br>Lime-sulfur 1-40, Kolofog 4 lbs. per 100 gals.<br>Lime-sulfur 1-40, Kolofog 4 lbs. per 100 gals.<br>Lime-sulfur 1-50, Kolofog 4 lbs. per 100 gals. | Jan. 19<br>Apr. 11<br>May 11<br>June 25 | .86 | 1.7 | + 97.6 |
| Bordeaux 3-4-50, oil emulsion (1% oil)<br>Bordeaux 1½-2-50 plus calcium caseinate<br>Oil emulsion (1% oil) | Jan. 19<br>Apr. 11<br>June 26 | 1.25 | 2.9 | + 132.0 |
| Bordeaux 3-4-50, oil emulsion (1% oil)<br>Bordeaux 1½-2-50 plus calcium caseinate<br>Lime-sulfur 1-40<br>Lime-sulfur 1-50<br>Lime-sulfur 1-60 | Jan. 19<br>Apr. 11<br>May 11<br>June 25<br>Aug. 6 | .95 | 2.0 | + 110.5 |
| Bordeaux 3-4-50 plus calcium caseinate<br>Oil emulsion (1% oil) | Jan. 19<br>June 26 | .47 | 2.2 | + 368.0 |
| Bordeaux 3-4-50 plus calcium caseinate<br>Lime-sulfur 1-40<br>Lime-sulfur 1-50<br>Lime-sulfur 1-60 | Jan. 19<br>Apr. 11<br>June 25<br>Aug. 6 | .45 | 1.5 | + 334.4 |
| Bordeaux 3-4-50, oil emulsion (1% oil)<br>Dry lime-sulfur 5 lbs., Kolofog 2 lbs. per 100 gals.<br>Dry lime-sulfur 5 lbs. Kolofog 2 lbs. per 100 gals.<br>Dry lime-sulfur 5 lbs., Kolofog 2 lbs. per 100 gals. | Jan. 19<br>Apr. 11<br>May 11<br>June 25 | .82 | .76 | — 7.5 |

1½-1½-50. The figures for the following comparisons were computed by averaging the counts of scale insects from the full strength and half strength Bordeaux plots where it was followed by the same insecticides. Comparing the plots that received lime-sulfur sprays following Bordeaux, the plot sprayed with lime-sulfur plus wettable sulfur showed 46 per cent decrease in living purple scale per leaf. The plot receiving straight liquid lime-sulfur showed an increase of 52 per cent. Dry lime-sulfur plus Kolofog showed a decrease of 24 per cent. living scale per leaf, and liquid lime-sulfur plus Kolofog showed an increase of .9 per cent. Although soda sulfur 5 pounds per 100 gallons plus 3 pounds of Kolofog showed a decrease in the per cent. of living scale, it gave very poor rust mite protection. The plot that received an oil emulsion had a 31 per cent. decrease of living scale per leaf, but that plot was dusted five times for rust mite control. In the plot that received Bordeaux, but no follow-up spray, there was an increase of 105 per cent. of living scale per leaf, and the untreated plot showed an increase of 55 per cent. One plot received four applications of dry lime-sulfur but no Bordeaux mixture. There was a 52 per cent. decrease in living scale per leaf in that plot.

In the majority of sprayed plots, better rust mite control was obtained where lime-sulfur, liquid or dry, was supplemented with either wettable sulfur or bentonite sulfur, than where only straight liquid lime-sulfur was used. Liquid lime-sulfur plus wettable sulfur had a lower per cent. of infested fields for the season than any of the other combinations. Comparing liquid lime-sulfur plus Kolofog and dry lime-sulfur plus Kolofog the results showed that these two combinations were about equal for rust mite control. Soda sulfur plus Kolofog gave very unsatisfactory results. The plot that received an oil emulsion after Bordeaux was dusted with sulfur dust five times, and the plot receiving no follow-up spray was dusted six times. The last application of spray was made August 6, which gave rust mite protection in the majority of plots until December 1. No accurate count of russet fruits was made, but there was less than 2 per cent. russet fruit in the lime-sulfur plus wettable sulfur and also in the lime-sulfur plus Kolofog plots, while an estimate of 30 to 40 per cent was in that grade in the dusted plots. See Table III for detailed results of the experiment.

In a general review of the experiments conducted during the past five years our results show that purple scale was reduced after three applications of lime-sulfur whether the applications were made at intervals of two weeks, six weeks, or longer periods of time. Two applications of lime-sulfur following Bordeaux mixture gave results comparable to one application of oil emulsion, and three applications of lime-sulfur following Bordeaux gave better results in most cases than one application of oil emulsion, especially when the first lime-sulfur spray was made during the first half of April. Lime-sulfur solution gave better purple scale and rust mite control when supplemented with some of the wettable sulfurs. The addition of one per cent. oil in a dormant Bordeaux spray did not give enough reduction in scale insects to warrant the use of that amount of oil, especially when the danger of cold and drought injury is considered. If an oil emulsion is desired as a spreader it is probably more economical to add just enough for that purpose and follow later with a scalecide. In the few tests that have been made with various copper compounds that do not leave any appreciable amount of residue better scale control was obtained with either lime-sulfur or oil when following those materials than when following Bordeaux mixture. Three lime-sulfur applications gave rust mite protection for periods ranging from seven to ten months with a very low per cent of russet fruits.

It should be understood by those who expect to control scale insects with lime-sulfur that a good coverage is necessary on the under sides of the leaves and on the limbs. The more recent method employed by some growers of applying the lime-sulfur from a moving sprayer is very likely to give unsatisfactory results, especially if there is any degree of scale infestation. This is particularly true when the trees have a dense covering of foliage and the lower limbs are near to the ground. The first mites usually found after an

application of lime-sulfur were on fruits hanging near the ground and on the inside limbs of the tree. Individual trees vary very greatly in the same grove, some having more or less foliage. If the spray machine is moving at the same rate of speed when it passes densely foliated trees as when passing sparsely foliated trees, those trees with dense foliage will not only receive much less spray material per unit of area than the sparsely foliated ones but will have far less spray on the inside of the tree. Purple scale infest limbs and twigs as well as the leaves, so it is quite obvious why a good coverage is necessary. If there is a light infestation and most of the scale insects are on the leaves, then less material might be used. If the first two applications of lime-sulfur are thorough the third can probably be made with more speed and still obtain fairly good results.

This paper should be considered as a progress report. The results of experiments presented here show the general trend of tests conducted for periods of one to five years. In some of the individual experimental plots the degree of control was contradictory to the general results. Many factors enter into field experiments besides the materials used and the program followed. Drought, abnormally long rainy seasons, hurricanes and

TABLE III

COMPARISON OF PURPLE SCALE AND RUST MITE CONTROL FOLLOWING BORDEAUX MIXTURE, LAKE ALFRED, FLORIDA
1934

| Materials Used Following Bordeaux Mixture | Purple Scale | | Rust Mites |
|---|---|---|---|
| | Per cent. increase or decrease of living scale per leaf | | Av. No. infested fields during the experiment |
| | Bordeaux 3-3-50 | Bordeaux 1½-1½-50 | |
| Liquid lime-sulfur 1-40<br>Liquid lime-sulfur 1-50<br>Liquid lime-sulfur 1-60 | + 75.0 | + 36.0 | 7.1 |
| Liquid lime-sulfur 1-40, Kolofog 2 lbs. per 100 gals.<br>Liquid lime-sulfur 1-50, Kolofog 3 lbs. per 100 gals.<br>Liquid lime-sulfur 1-60, Kolofog 4 lbs. per 100 gals. | + 28.0 | + 14.0 | 5.8 |
| Liquid lime-sulfur 1-40, wettable sulfur 2 lbs. per 100 gals.<br>Liquid lime-sulfur 1-50, wettable sulfur 3 lbs. per 100 gals.<br>Liquid lime-sulfur 1-60, wettable sulfur 4 lbs. per 100 gals. | — 28.0 | — 58.0 | 3.6 |
| Dry lime-sulfur 5 lbs., Kolofog 2 lbs. per 100 gals.<br>Dry lime-sulfur 5 lbs., Kolofog 2 lbs. per 100 gals.<br>Dry lime-sulfur 5 lbs., Kolofog 2 lbs. per 100 gals. | + 20.1 | — 18.0 | 5.6 |
| Oil emulsion (1% oil)<br>4 applications of Sulfo-dust, 95% sulfur | — 36.2 | — 24.6 | 29.8 |
| 5 applications of Kolodust, 70% sulfur | + 167.1 | + 67.2 | 20.2 |
| *Dry lime-sulfur 5 lbs., Kolofog 2 lbs. per 100 gals.<br>Dry lime-sulfur 5 lbs., Kolofog 2 lbs. per 100 gals.<br>Dry lime-sulfur 5 lbs., Kolofog 2 lbs. per 100 gals.<br>Dry lime-sulfur 5 lbs., Kolofog 2 lbs. per 100 gals. | — 51.9 | | 9.3 |
| Check—no spray or sulfur dust applied | + 55.7 | | 59.0 |

*Received no Bordeaux. 1st. application made at the time the Bordeaux sprays were applied. Dates respective sprays were applied: Bordeaux mixture, April 9. 1st. application of sulfur, April 30. 2nd. application of sulfur, June 8. 3rd application of sulfur, Aug. 6. Oil application, June 8.

other uncontrollable factors may greatly affect the results from one year to another so that it is necessary to conduct the experiments over a period of years to be able to draw definite conclusions for any one material or program to be followed.

## THE FREEZE OF DECEMBER, 1934

**U. S. Weather Bureau: Climatological Data, Florida Section, December, 1934**

The freeze of December 12th and 13th was the most severe since 1928 over the western and northern divisions of the state, and the most severe and damaging since 1917 over the central and southern divisions. It was the first severe freeze ever recorded in Florida so early as the first half of December.

Cold weather prevailed over the whole state on the 9th, with heavy frosts reported even over the southern interior, and considerable damage was done to tender truck in the Everglades section. Temperatures rose on the 10th under the influence of an area of low pressure centered over the Carolinas. By the morning of the 11th, this low pressure had moved eastward to the North Carolina coast, and an extensive area of high pressure and low temperature had moved southeastward over the lower Mississippi Valley and the middle Gulf States. This distribution of barometric pressure is typical of conditions immediately preceding severe freezes in Florida. Warnings were accordingly issued for a hard freeze that night with temperatures as low as 22° in the north, and as low as 24° in the central portion of the state, and for heavy frost and freezing temperatures in the southern interior. Caution was added that freezing temperatures were probable again the following night (Wednesday night).

By the morning of Wednesday the 12th, the low pressure area had moved rapidly eastward over the Atlantic, increasing in intensity, while the high pressure area had moved slowly southeastward. Temperatures fell below freezing over the entire state, except over the southern keys. Long Key, 25 miles south of Cape Sable, reported a minimum of 37°, equalling the record of 1917, and Key West had a minimum of 45°. Temperatures below 20° occurred at many places over the northern and western divisions of the state, and at some points in the central and southern divisions.

Warnings of not quite so cold but with temperatures below freezing were issued on the morning of the 12th. On the morning of the 13th, temperatures over the western and northern divisions and at most of the stations in the central division were somewhat higher, but at a number of locations in the southern division and at a few locations in the central division temperatures were as low or slightly lower. Homestead, 25 miles south of Miami, had a minimum of 26°.

The freeze resulted in wiping out all tender truck throughout the state, except on the southern islands, and close to the southern coasts. Snap beans, eggplant, peppers, green peas and tomatoes were practically all destroyed. Cabbage, escarole, turnips and carrots were badly damaged, and the yield of celery was greatly reduced. Irish potatoes were cut to the ground in the south, but in the north, very few potaoes had yet been planted. Strawberries had all the bloom killed and the fruit damaged severely, but in general plants were not killed, and with favorable conditions shipments of fruit will be made after the delay of a few weeks. Avocado trees were badly frozen, and many killed. Ornamentals, as hibiscus, oleanders, and tender palms, suffered much damage.

As it was early in the season, the bulk of the citrus crop was still on the trees. The Florida Citrus Exchange estimates that 38.4 per cent. of the citrus fruit on the trees was frozen (oranges 39.1 per cent., grapefruit 36.3 per cent., and tangerines 66.2 per cent.). Some fruit men place the loss considerably higher. The district showing the smallest per cent. of frozen fruit was the east coast; the district showing the greatest was the

western area from Brooksville south to Ft. Myers. Because of the second cold night, the loss over the southern half of the citrus belt was as great or greater than over the northern half. Groves in favored locations with water protection suffered little. Small groves on the St. Johns River just south of Jacksonville had no frozen fruit. The Bureau of Agricultural Economics, from Orlando office, has issued a revised estimate of Florida citrus as of January 1, 1935, for the season 1934-35. A total production of 24,500,000 boxes is indicated, of which 13,500,000 are oranges and tangerines, and 11,000,000 grapefruit. This is fruit for all purposes, including fruit for canning and local consumption as well as the shipped crop. The estimate of October 1st was 36,000,000 boxes. The estimate of the commercial crop for shipment has been reduced from 30,000,000 boxes as of October 1st to 19,500,000 boxes. The total crop last year (1933-34) was nearly 29,000,000, and the commercial crop 24,000,000 boxes.

Many young trees were killed, and many older trees were badly frozen back and injured. As usual, seedling trees seem to have suffered less than the budded varieties. No estimate can yet be made of the amount of damage to the trees, and the amount of loss will depend to some extent upon the weather during the remainder of the season. The trees defoliated and frozen back, but not killed, are now (January 15th) putting forth much new growth. If the weather continues favorable throughout the winter, this will mean rapid recovery; but if another severe freeze should come later this winter, this might mean a repetition of the disaster of 1895.

Following is a table showing, for a number of stations of long record, the lowest temperatures recorded this year, and in the previous freezes of 1886, 1894, 1895, 1899, 1905, 1917, 1928, and 1934.

MINIMUM TEMPERATURES DURING FLORIDA FREEZES

| Station | 1886 | 1894 | 1895 | 1899 | 1905 | 1917 | 1928 | 1934 |
|---|---|---|---|---|---|---|---|---|
| Arcadia | .... | .... | .... | .... | 23 | 21 | 23 | 21 |
| Archer | 14 | 13 | 15 | 10 | 21 | 18 | .... | .... |
| Avon Park | .... | 21 | 23 | .... | 22 | 27 | 29 | 21 |
| Bartow | .... | 20 | 22 | 22 | 22 | 26 | 24 | 23 |
| Bradenton | 23 | 19 | 23 | 25 | 27 | 21 | 28 | 25 |
| Brooksville | .... | 17 | 16 | 18 | 18 | 18 | 21 | 20 |
| Cedar Keys | 15 | .... | .... | .... | .... | 20 | 22 | 24 |
| Clermant | .... | 20 | 18 | 20 | 21 | 23 | 23 | 25 |
| Eustis | .... | 16 | 16 | 17 | 20 | 20 | 22 | 24 |
| Ft. Myers | .... | 24 | 30 | 28 | 27 | 27 | 30 | 29 |
| Ft. Pierce | .... | .... | .... | .... | 24 | 26 | 32 | 30 |
| Gainesville | .... | .... | .... | 6 | 16 | 17 | 15 | 16 |
| Hypoluxo | .... | 26 | 29 | .... | 26 | 28 | 31 | 31 |
| Inverness | .... | .... | .... | 14 | 20 | 20 | .... | 17 |
| Jacksonville | 15 | 14 | 14 | 10 | 17 | 16 | 19 | 23 |
| Lake City | .... | 17 | 15 | 6 | 16 | 15 | 17 | 20 |
| Merritts Island | 26 | 22 | 22 | 24 | 24 | 26 | 30 | 29 |
| Miami | .... | .... | .... | 29 | 29 | 27 | 32 | 30 |
| Ocala | .... | 19 | 16 | 12 | 18 | 18 | 18 | 20 |
| Orlando | .... | 18 | 19 | 20 | 21 | 22 | 24 | 22 |
| Pensacola | 15 | 14 | 11 | 7 | 18 | 17 | 17 | 25 |
| Plant City | .... | 19 | 21 | 20 | 15 | 24 | 23 | 21 |
| St. Augustine | 17 | 16 | 16 | 13 | 18 | 18 | 20 | 23 |
| St. Leo | .... | .... | .... | 19 | 20 | 22 | 20 | 22 |
| Sanford | 21 | .... | .... | .... | 19 | 22 | 26 | 25 |
| Tallahassee | 12 | 12 | 11 | —2 | 17 | 15 | 15 | 20 |
| Tampa | .... | 19 | 22 | 22 | 23 | 26 | 26 | 27 |
| Tarpon Springs | .... | 19 | 22 | 20 | 24 | 24 | 24 | 25 |
| Titusville | .... | 18 | 19 | .... | 19 | 23 | 24 | 23 |

# FLORIDA FREEZES AND LESSONS FROM THEM

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### CLIMATE

In this great land of ours, we have many varieties of climate, to suit all kinds of people. Each section has its peculiar advantages and disadvantages. Personally, I am a great booster for Florida climate, and consider that we have the very best there is. I would much rather talk to you about its glories, and its good points than about its defects, but that is not the way it is put down on the program, so I shall have to talk about Florida freezes and lessons from them.

### STUDIES

I have studied Florida freezes for 23 years; the early freezes from books, charts and old records, and the freezes of 1917, 1927, 1928, and 1934 from actually experiencing them, and tracing their progress on the weather maps. In the course of my study, I prepared maps showing the weather conditions on the morning of each freeze, and on the mornings of the two dates preceding; also charts showing the lowest temperatures reached in each locality on each date. My file of charts included near-freezes, in fact every cold spell that brought the temperature to freezing or below in Tampa. Our records begin with 1876. Back of that we can get little exact information, although we do know that severely cold weather occurred in 1835 and in 1857.

### LIMITING DATES

In general we may say that a real freeze is not likely earlier than the middle of December nor later than the middle of February. But this year, with a freeze coming December 12th, showed that we cannot rely on limiting dates. In fact, in 1876, we had very cold weather the first week in December, with temperature below freezing every day in Jacksonville from December 1st to December 6th. Although records are scanty, we do know that this cold weather of 1876 extended far down the state. Punta Rassa had light snow on December 1st, and a temperature of 34 on December 2nd, which would indicate freezing and below over the interior of extreme southern Florida. On November 21, 1914, freezing occurred as far south as Arcadia. Nor can we limit the danger period in the spring to narrow bounds. We all know that March frosts occasionally do much damage. The very latest record we have of cold weather was in 1891, when on April 7th, freezing temperatures occurred in Polk and Lee counties.

### EIGHT BIG FREEZES

There are not many winters pass without some damage by cold in central and interior of south Florida, but there have been in the past 64 years only eight big freezes, accompanied by temperatures 20 to 25 degrees in the citrus belt, which means low eonugh to freeze fruit rather generally, and damage young trees. These were January, 1886, December, 1894, February, 1895, February, 1899, January, 1905, February, 1917, January, 1928, and December, 1934. Eight in 64 years means an average interval of eight years, but the average interval does not mean much since the longest interval was 12 years, from 1905 to 1917, and the shortest less than two months, December, 1894, to February, 1895.

### EXTREME TEMPERATURES

I have prepared a series of charts showing the lowest temperatures reached at different points during the eight freezes (see page 108), and one showing the lowest temperature *ever* reached according to our records. The lowest on record for the whole state was two below zero at Tallahassee in 1899, and at the same time, an even zero was recorded at DeFuniak Springs. The extreme lowest temperature ever recorded at St. Andrews, was 4 above zero, at Gainesville 6, at Plant City 15, at Arcadia 20, and at Flamingo 30.

During the boom, people did not want such information, and in 1925, an article published in the Florida Grower on Florida freezes caused

me quite a little trouble. Threats were even made to have me removed from the Tampa office. But it does get cold sometimes in Florida and there is no use trying to dodge the issue.

We know that there is no point on the mainland of Florida that has not had freezing temperature at one time or other. Of course, the further south, and the nearer the coast, the less frequent, and the less severe are these occurrences of cold weather. Key West alone can boast of being definitely below the frost line, for the lowest temperature ever recorded in the Island City was 41.

AVERAGE NUMBER DAYS FREEZING

The average number of days per winter that temperature of 32 or below has occurred is shown on this little chart. The number ranges from 15 per winter in the extreme north to less than once in five years in the extreme south. The average of at least once per winter covers the interior of Central Florida and a large part of the interior of South Florida, and there is very little of the state that does not have freezing at least once in five years on the average. When we make a chart of the average number of times per winter with temperature 25 or below, which we may take as marking the damage point for citrus, the result is a little more encouraging. But the average of once per winter runs through Lake Sumter and Hernando counties, and the line showing the average of one year in ten dips far down into the southern interior. When we take temperatures 20 degrees or below, we find the line marking once in ten years runs through the heart of the citrus belt.

PROBABILITIES ANY GIVEN WINTER

The charts we have just described, are perhaps hardly fair, for they do not indicate the probabillity of any particular temperature in any given winter. We all know that we do have winters, sometimes several in succession without any really cold weather, while in other winters we may have several cold periods. The probability of freezing, 25 degrees, and 20 degrees in any given winter has been figured out on three charts. One hundred per cent. probability of freezing covers the northern interior. The 90 per cent. line runs through Volusia, Lake and Marion counties. Fifty per cent. runs through Brevard, Osceola, Polk, Hardee and Manatee counties, and the greater part of the citrus belt has a probability of 30 per cent. or above.

Considering probability any winter of temperature 25 or below, we find the 30 per cent. line runs through the heart of the citrus belt, and that the greater part of the belt has a probability of 10 per cent. or more. Considering temperatures of 20 or below, we find most of the citrus belt has a probability of less than 10 per cent. All these charts, are of course, only rough approximations, as we used only stations with 30 years record or more, and there are not many of these.

CHARACTERISTIC MAPS

When we study the daily weather maps of the historic freezes, and near-freezes, we find certain points of resemblance. But each occurrence presents individual problems, and because a current map looks very much like one that preceded a former freeze, it does not follow that the resulting temperatures will be the same. Forces are at work, and changes take place that we do not fully understand, and the resultant cold may be more severe or less severe than the map would seem to indicate.

The characteristic map preceding a cold wave in Florida shows a great area of high barometer and low temperature moving down from the northwest, or moving eastward over the Gulf states; while an area of low pressure is moving off the Atlantic coast, or northeastward along the Atlantic coast. It takes both the push of the high pressure and the pull of the low, to bring about a great fall in temperature. From the passage of the low, we often get rain in Florida; hence the idea that winter rains must be followed by cold weather has a good foundation. However, the low may be too far north to give rain in Florida, and yet may give the necessary pull, and some of our cold waves have not been preceded by general rains.

The degree of cold we get depends upon several factors, of which the best recognized are (1) the intensity of the high and the intensity

of the low, or the difference between the barometer readings in the high and low; (2) increase or decrease in intensity of the high and the low; (3) direction and speed of motion of these high and low pressure areas and (4) the temperatures prevailing in the high pressure area, and the temperatures prevailing over the Florida Peninsula. The intensity of the high must usually be 30.60 or above; the intensity of the low 29.90 or below; and the greater the intensity of either, the greater the probability of very cold weather. An increase in intensity of either tends to accentuate the cold, a decrease tends to mitigate it. Rapid movements tend to bring in the cold air rapidly, but to cut short the duration of the cold, and to keep it from coming so far south. As to direction, if the high as it drifts eastward moves toward the south, the cold is more severe, extends further south and lasts longer; if it moves a little toward the north, northeast winds set in over the Peninsula and the worst of the cold is over. The lower the temperatures to the northwest of us, the colder the weather we may expect. Of course if the existing temperatures over Florida are rather high, that fact tends to mitigate the cold, and the protection of a lake to the north or west is then especially valuable.

MAPS

I have maps here showing the barometer and temperature lines Feb. 7 and 8, 1895, showing an unusually well developed *high,* and a well developed *low,* increasing in intensity. As you all know this was one of our big cold waves. I have maps also showing the December freeze of this past winter, which was somewhat worse than we expected, and the February freeze which failed to reach central and southern Florida with any great intensity.

On the morning of Dec. 11th, the center of the high was over southern Missouri and the low was off the North Carolina coast. Freezing temperatures occurred this morning over northern Florida. Warnings were issued for hard freeze with tempeatures 24 to 26 in north; 24 to 28 in central, and freezing or below in interior of extreme south. A few reports received in the late afternoon and early evening indicated that the cold might be even more severe than was anticipated, and effort was made by radio and telegraph to intensify the warnings, but of course no widespread distribution of such warnings could be obtained. The map of December 12th showed temperatures at some places lower than had been indicated the preceding morning. It showed, however, the high pressure area diminished in intensity, and apparently moving eastward. Warnings were issued for not quite so cold, but temperatures 26 to 30 in north, freezing or below in interior and near freezing in extreme south. Late afternoon reports indicated lower temperatures, and effort was made to intensify the warnings.

The map of December 13th showed that the high had decreased considerably in intensity, but had moved southward over the Gulf, and although it was slightly warmer over northern Florida, it was just about as cold over central and southern Florida as on the morning of the 12th. A few places in the extreme south showed even lower temperatures.

The map of February 27th showed a well developed high over Arkansas, Texas and Louisiana, with a low on the north Atlantic coast. Warnings were issued for 25 to 30 in north Florida; 28 to 32 in central Florida and 32 for interior of south Florida, which were verified almost exactly. On the morning of the 28th, the high had increased in intensity and was apparently moving southeastward. Warnings were issued for continued cold, or slightly colder weather over the greater part of the state. Late afternoon reports seemed to indicate that the high was moving more toward the eastward, with probability of winds from the northeast over the Peninsula, and effort was made to modify the morning forecast to indicate temperatures not so low.

The morning map of March 1st, showed the high wind had moved a little north of east, and although temperatures were slightly lower in extreme north Florida, they were higher over most of central and southern Florida, and above the danger point over the citrus belt.

To be of value to the grower, he should have

the warnings by 11 A. M., and these warnings must be based upon the 8 A. M. reports. Although in a general way, warnings may be issued earlier than this, they cannot be of much accuracy. These morning warnings should again be checked up by noon or early afternoon reports. We have arranged to receive 2 P. M. reports, and next winter can issue supplementary warnings a little after 3 P. M. This may be of considerable help, if we can secure distribution. Prompt distribution can be made by radio, and we will have the co-operation of all the broadcasting stations. The time will be announced late, probably 3:30, with a repeat at 4 P. M.

If Congress passes the appropriation for the special frost fruit service for Florida, we can look for greater accuracy, and greater detail in the forecasts, and a much better system of distribution. Just what can be done cannot be determined until a survey of the field is made, and this probably will be done some time this summer. Meanwhile we ask your patience and your co-operation, and would be glad of any suggestions that are made.

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Question: How about February 2nd and 3rd? We had a freeze in Avon Park and that section.

Dr. Bennett: I haven't the reports here. It was not widespread, was it?

Question: It just lasted a few hours.

Dr. Bennett: All through February we issued warnings, nearly every day, but December and February were the only times we issued real freeze warnings. I think that I averaged about fourteen hours a day during last winter, at the office. There wasn't much to attend to after the warnings were issued, but I checked up as well as I could and answered the phone. Anyway, I tried to be on the job. To be of real value to the growers, you want to get the warnings as far in advance as you can and that is one reason I am here to let you understand some of the difficulties. We can't possibly get anything very accurate farther ahead than twenty-four hours. We get our reports in at eight A. M. Before the map can be made and the warnings out it is about 10:30. Before the grower can get it, it is about eleven. That's about as early as we can get any reliable forecast. Once in a while we can warn you of impending cold, but not to any accuracy of the degree of that cold. Then, later on in the day, we will get further reports. This next winter we expect to get reports at two P. M. and make arrangements to confirm, cancel or intensify the warnings of the morning by radio.

All the radio broadcasting stations that I have interviewed so far will co-operate with us and probably will get out a broadcast about 3:30 or four in the afternoon to give the very latest report and indications for the morning, modifying the warnings already sent out. That's about all we can do in advance of the appropriation for a frost fruit service for Florida. It is our hope that appropriation will go through and we will have one of the frost fruit experts from California over here, simply to see that we don't make mistakes in starting our service. Any one having experience in that line has something to start from. It is my hope that we will get one of the men that Floyd D. Young has trained, to make a survey of the state and establish stations; perhaps a central station in the center of the state to handle these warnings, and evolve a system of distribution. No definite plans have been made.

I was talking to the chief of the weather bureau in New Orleans a month ago, and all the plans still are very vague, waiting on the appropriation to see what we can do. Meanwhile, if you have any suggestions to make, we will be glad to have them, either as to getting reports or distributing them. There is no use in our getting warnings accurately unless we can get them out and unless they can be used. I believe various broadcasting stations of the state can be heard nearly everywhere during the day in the winter time. This is a rather rambling talk and I would be glad to have anybody ask any questions or start a discussion and tell me things.

Question: Can you tell me about how rapidly those highs travel east?

Dr. Bennett: There is so much variation that it is almost impossible to give an average. I would say about 600 miles in twenty-four hours,

perhaps, on the average. Sometimes they are almost stationary, sometimes they move rapidly.

Question: Here's a rather hypothetical question. Suppose President Roosevelt succeeds in putting up that timber belt, do you think that would have anything to do with climatic conditions here?

Dr. Bennett: Not appreciably. The trees would only be from 30 to 40 feet high. This cold air runs up to 14,000 feet level.

Question: I have a friend who always makes barometer readings every day. Could you give us some information about how to use the barometer in regard to protecting against these freezes?

Dr. Bennett: When you think that we get barometer readings twice a day from all over the United States, and still we are not always successful, you can see that the barometer reading in one place would not give you anything very definite. Almost invariably, of course, there is a rapidly rising barometer with a cold wave. The barometer has been low and rises; but early in December we had frost clear down in the interior of the state with a low barometer on December 8th and 9th and if we depended on the barometer for that it would not have shown us because it was about normal. That is one reason that made the cold wave so effective on December 11-12-13, because the ground was already cold from the 8th and 9th and then it warmed up just a little bit one day. So you can roughly see that when the barometer is low and rises rapidly in the winter, and the wind shifts to the northwest, expect cold; and the greater the rise the faster and more severe the cold will be.

Question: How difficult would it be to get say three stations of the frost service established at strategic points in Florida?

Dr. Bennett: We are thinking of more than that.

Question: I am thinking of the branch of the Fruit Frost Service. I live at Miami and have been many years growing papayas. One of our problems in Miami has been that while Mr. Grey gets morning observations, he does not get any in the afternoon. The probability of frost, of course, changes rapidly between seven A. M. and nine P. M. I have just put in three years in the Rio Grande Valley and they put in frost service and it made an awful difference in what we did to prepare for frost over there. Of course, here in Florida, we don't get frost often, but it seems to me that if we had, for the period when frost is possible, about three men trained in frost broadcasting, we could improve our situation, a great deal, because the radio station, of course, broadcasts about three times a day, the last at nine o'clock, and when that's over, you know just about what temperature it is in each locality.

Dr. Bennett: The nine P. M. forecast is based on the seven P. M. reading. There should be one sent out later. When I was in conference with the chief and head of the chronometer division, he said he would get one of Mr. Floyd Young's experts from California and go over the state with me and we would make a survey and then decide what we could do; that probably some central station would be established, perhaps at Orlando, and then sub-stations. There should be one in your locality, because you could have it forty degrees colder than the Miami readings.

We would move the weather bureau to the airport and then the temperature now being taken off the roof would be taken on the ground. They have agitated this same thing at Tampa, but you know if they reduced the temperature readings at Miami there would be some complaint.

Question: I have seen the time plenty of times when there was 14 degrees difference outside the papaya patch and the temperature Grey had on top of the Seybold building. In 1928 it was 17 degrees for five and a half hours and I could see the clock on top of the courthouse at Miami; but just the same, that territory down there is entitled to accurate forecasts of frost on the evening it is going to occur.

Dr. Bennett: During the last year, we have been getting reports from the airport at Miami and using them in connection with our forecast. Even this would not be as cold as you might have it. It wouuld be utterly impossible to forecast for every particular locality, but if we could get some idea to you, you could make allowances.

On December 13th, every regular weather bureau station in Florida, including Miami, showed it was warmer than on the 12th, but you know

that in South Florida it was not warmer and you will find that discrepancy especially the second night of a cold period, because then the wind is down and radiation is what gives you the cold. On the evening of the 8th the temperature at my office in Jacksonville on the roof was 43 degrees and at the airport at the same time it was 34 degrees—nine degrees difference, which is rather unusual so early in the night.

Question: I would like to know how far north or south of Jacksonville the low pressure area usually is when it brings a cold wave into Florida.

Dr. Bennett: It is usually north.

Question: Off Savannah or off Charleston?

Dr. Bennett: Sometimes it is clear up here and considerably off that way and sometimes it crosses extreme North Florida and goes up the coast, but we have got to have a low moving out and a high moving in to get the dynamics of the cold wave. The further north, the less effect it has.

Question: As a usual thing, when it passes Savannah, we are free?

Dr. Bennett: No, it could be way up here and still there would be danger.

Question: Will they probably move the readings from the location in Tampa also? There are some cold areas just outside Tampa where there would be a difference of fifteen degrees.

Dr. Bennett: I know that. Lewis Muck Farms had everything frozen when the minimum temperature at Tampa was 50 degrees. Of course that is one extreme. The office in charge down there is working on the proposition and will have a substation next year. It may not be the official station for Tampa, but we will receive the report at Jacksonville and use it in our forecasting. I wish you would write me any suggestions you have. We are going to take up this thing and do something about it this summer. I stay in my office most of the time and I don't meet you folks as I would like to. I am not a practical man, for I work the best I can with figures to get the warnings out, but anything as to the set-up of the new fruit frost service I would be glad to have and will carry out as far as possible.

Question: Does the Society wish to pass any resolution memorializing our congressmen and senators, or is such a memorial necessary to put the necessary appropriation through. Where do we stand?

Dr. Bennett: I think they are going to make that appropriation. I believe the Appropriations Committee of the House has approved it. The appropriation has not been made, but we have no reason to think it will not be when it finally comes before the House.

Question: Is it $15,000 or $20,000?

Dr. Bennett: I understand it is $15,000.

Question: What is the appropriation in California?

Dr. Bennett: It is much bigger there, but you want to know that California goes 50-50 on that service—the growers themselves pay half.

## SOME LESSONS LEARNED IN TWO FREEZES

**A. F. Camp, Horticulturist**
**Florida Agricultural Experiment Station**

The factors involved in freeze damage may be roughly classed under three headings:

1. Those having to do with location.
2. Those having to do with grove management, and
3. Those having to do with cold protection by heaters or other means.

Those factors falling into the first category have to do with such things as contour of land (air drainage); water protection, character of soil, and the simpler problems of latitude. These factors will not be discussed to any great extent in this paper as they have already been gone over many times in this Society and any good citrus grower realizes the value of water protection and the importance of a warm location resulting

from proper air drainage. Thee is one question that is of interest, however, and, while it will not be possible to discuss it at length, it deserves considerable thought. This is the question of rehabilitating groves in cold locations. There is a great deal of acreage that was frozen back very severely in the winter of 1927-28 and rehabilitated at considerable outlay plus the loss of two or three seasons' crops, and much of this same acreage was severely injured this winter and will not bear sizeable crops for at least two and probably three years. I think it is a fact that a great proportion of the large profits made in growing citrus has been made during the years of good prices following freezes. Profits during such years only accrued to those who had groves practically uninjured by cold, while those who had to stand the expense of rehabilitating groves found themselves out of the most profitable markets. While groves in such cold locations might conceivably be saved by grove heating, I am inclined to wonder whether it would not be better to abandon attempts to establish groves in very cold areas and limit the development of groves to the better protected locations. This is a question on which the owner of a grove in a cold location might spend considerable thought before putting any large amount of money in grove rehabilitation and grove heaters. Some groves in such locations are peculiarly favored by especially desirable soils or some other factor, while others may have little to recommend them. All things should be carefully weighed before making a decision.

Turning, however, to those factors over which the grove owner may have some control, we find many things of interest. Following the cold weather of January, 1928, we traveled over considerable of the citrus area studying the effects of the cold and much of this has been repeated this year. Mr. Blackmon and Mr. Wilmot of the Department of Horticulture also carried on this year some systematic survey work to check the conclusions we had previously reached.

It might be well to say something at this point concerning the difficulty of collecting usable data on the effect of grove factors, for it is this very difficulty which often leads to erroneous conclusions from casual observations. In the first place, it is necessary to eliminate areas in which there is a general killing of wood and trees, for differences disappear under these conditions. Taking those areas in which not all of the trees are severely damaged, great care must be exercised in locating grove areas in which air drainage, wind protection or water protection do not account for the observed differences. A causal glance at a grove often brings the remark that grapefruit stand more cold than oranges or *vice versa*, whereas the actual difference is due to air drainage or some other factor that actually caused one block to be subject to more cold than another. At critical points only a few feet difference in elevation will cause a decided difference in the damage done. All conclusions concerning grove factors must therefore be drawn with great care.

Considering oranges, grapefruit and tangerines, the survey seemed definitely to support the opinion that tree condition was the foremost factor in influencing the response of trees to cold weather. The effect of *fertilizer, cultivation, time of harvesting* and *pest control* all played a part insofar as they affected the condition of the tree. Strong, vigorous trees consistently fared better than did weak or undernourished trees. There has been a persistent idea that half-starved trees are harder and will consequently stand more cold, but this has not been borne out in either 1928 or the present winter.

There was evidence that grapefruit trees were a little hardier than orange trees when in comparable conditions of growth and that tangerine trees might be a little hardier than either, though the fruit of the latter is very susceptible to cold damage. The differences are slight and the best information was obtained from trees carrying mixed tops. The differences were so small that they were totally obscured in most cases by differences in vigor, frequently arising from difference in time of removing the fruit.

Rootstocks apparently played only a small part, though there was one case in which there was a good comparison of trees budded on rough lemon, sour orange and grapefruit rootstocks, and the latter seemed to have helped the tree to with-

stand the cold a little better than the other two. This was possibly another case of the effect of vigor and cannot be taken as a general criterion.

Varietal differences within a species were very hard to detect. The statement was frequently encountered that the Parson Brown was the hardiest orange. The results of the survey would indicate that this opinion arose in large measure from the fact that the fruit of the Parson Brown is usually harvested early and the trees have a chance to recover considerably before cold weather. They also have a tendency to smaller crops than Pineapples and a consequent tendency to more vegetative vigor. This only goes to substantiate further the value of the common recommendation to utilize cooler locations for early oranges and to plant late varieties only in the warmer locations. In addition to the fact that the trees suffer more when carrying a crop, green fruit is more easily frozen than ripe fruit, so that the grower may lose in two ways if he plants late oranges in the colder locations. Most of the differences in varieties and rootstocks may therefore be said to hinge in one way or another upon the question of vigor, which seems to play a much larger part than other grove factors.

Little need be said concerning other types of citrus. As was known, Tahiti limes, Perrine lemons and other lime and lemon fruits suffered more severely than did oranges and grapefruit. A peculiarity in this connection is the Meyer lemon, which was usually badly damaged in central Florida, commonly showing about the same resistance to cold as the orange, but which came through in good shape at Cairo, Georgia, and is blooming heavily now.

Turning to the question of grove heating, there are a number of things that have been learned and foremost in this connection is the fact that grove heating properly and intelligently applied will protect many groves from cold but that only a few growers understand it sufficiently well to obtain first-class results. For this reason, we wish to discuss some of the important factors in such a way as to make the basic ideas clear, for grove heating improperly used may result in the loss of fruit and trees, as well as the cost of firing. Many of the things I am going to say here have been said before, but the observations of this winter indicate that they need to be repeated, and with emphasis.

Of first importance is the question of thermometers and their use. Thermometers are the steering apparatus for grove heating and you can no more control grove heating to your advantage without steering equipment than you can use an automobile without it. The thermometers should be accurate at temperatures between 20 and 32 degrees Fahrenheit and the ordinary thermometers are very seldom accurate in this range; in the low twenties it is not uncommon to find them several degrees off. The thermometers should be easy to read and the mounting should be substantial enough to make them easily handled. Preferably they should be of the minimum recording type. Special thermometers for this purpose are sold by the H-B Instrument Company of Philadelphia and the Taylor Instrument Company of Rochester and the name under which they are listed is "Minimum Recording Frost Thermometer." These thermometers are calibrated particularly for the temperatures below 32°, are filled with a red liquid instead of mercury, and have a metal spindle in them which records the lowest temperature reached, the spindle being reset by tilting the thermometer.

The thermometers should be mounted so that they are protected from the sky but a complicated or elaborate mounting is not necessary. A simple mounting may be made from a strip of board nailed to a post, on which the thermometer is mounted, and another horizontal piece of board sheltering the thermometer. The thermometers will have to be mounted horizontally so that the minimum recording spindle will work properly. At least two thermometers should be mounted north of the grove and away from the effect of the heaters, to act as guides to the extent of firing necessary, and others should be mounted in the grove to determine just what is being accomplished. The number in the grove will have to be determined by the contour of the land. Any cold spot should have a thermometer and a few others should be used in the warmer portions of

the grove. *Thermometers are important and should not be overlooked.*

Learn to read the thermometer quickly and accurately. The reading must be carried out with the eye at right angles to the top of the indicator column or the reading will be inaccurate. If the reading is not done quickly the heat from the body or breath or from the source of light will cause too high a reading. Always use a flashlight, as matches give off too much heat, particularly when held close to the thermometer.

Having gotten thermometers, learned how to read them accurately, and located them properly in the grove, steer your heating by their readings. In order to do this, determine first what temperature you wish to maintain and heat just enough to maintain it; more heat used is a waste of fuel. Ripe fruit will be undamaged at 28-29° F. and the maintenance of a higher temperature wastes fuel which costs money. The fuel wasted in one night's overheating will pay for a lot of thermometers.

I have deliberately discussed thermometers ahead of the question of heaters and fuel, since they are an absolute necessity for any intelligent frost protection based on the use of burning fuel.

Three types of fuel are readily available for grove heating in Florida, i. e., Wood, Coke or Coal, Fuel Oil. Each of these fuels gives off a definite amount of heat when completely burned and this is an important fact to understand. A pound of oil will give off about 19,000 heat units when burned, a pound of coke about 14,000 and a pound of wood about 8,000 to 9,000. These values are characteristics of the fuel and no heater yet designed can find any way of getting extra heat out of the fuel, though some give less, due to incomplete combustion, and this is commonly indicated by the excessive formation of smoke. Taking the above figures as a rough basis, we can compare fuel values.

Taking a base price for fuel oil of five cents per gallon, approximately the price for car lots at Port Tampa, wood is worth over $10 per cord, depending on quality of the wood, and coke is worth a little more than $10 a ton. The figures for wood to be approximations, as we have no actual figures on fuel value of light wood and we can only use an approximation for the weight of a cord. The figures given, however, are very conservative. As a matter of fact, oil cannot be obtained in citrus areas at five cents per gallon under present methods of distribution. Correspondence with County Agents and others in the citrus counties indicates that light wood is being obtained at from $2.50 to $5.50 per cord in the grove. At such prices, wood is by all odds the cheapest fuel available.

Wood has certain shortcomings which partially offset its cheapness. First of all, it must be lightwood or it will deteriorate in the grove very quickly, and lightwood is getting harder to obtain. It requires more labor to keep fires going, and the fires are harder to control. Some wood heaters are on the market and these are intended to mitigate the above difficulties. The cost of labor is the big item when wood is compared with oil, but this is offset by the initial cost of oil-burning equipment. Proper equipment of a grove with oil heaters will cost $100 per acre and up, depending upon the coldness of the location. In addition to heaters, storage tanks for oil, tank wagons for distribution and storage sheds for heaters during the summer season are necessary.

If labor is high or lightwood unavailable, either oil or coke will have to be used. The choice in this case will depend, first, on prices for fuel. Oil requires less labor at the time of firing and fewer heaters to the acre. Provision must be made for fuel storage and heater storage in both cases, as the heaters will deteriorate very rapidly during the summer rainy season if left in the grove.

The choice of fuels where wood is not practical is likely to become a geographical one; i. e., close to the ports oil will probably be cheapest, while, in the areas more remote from the ports, coke or coal from Alabama will probably be cheapest.

Having decided on the type of fuel to be used, prepare yourself thoroughly, for the work in hand. Study the problems of reading your thermometers, lighting the fires and refueling before and not during the cold weather, so that there will be no slips. Systematically train your regular help in what must be done and have them and the equipment ready to proceed with firing at the

proper time. This is extremely important, for a failure on the first occasion may severely injure the grove and cause the loss of a great deal of money in fruit, trees and fuel, which might easily have been saved.

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Question: I think perhaps what you have discussed today about the comparative trouble and cost of different types of heating should be published this summer. We had this up in the Lake County Horticultural Association and I used the same argument as you have done here regarding the situation, but there were several there using oil and they said it was a great deal more trouble with the oil. I have wondered if it would be possible to briquet it. We have lots of sawdust and muck.

Mr. Camp: They used coal briquettes in the west. But one of the difficulties in briquetting oil is keeping down the amount of smoke. When it smokes you lose fuel. What you want is heat, not smoke. The brighter the flame burns the more benefit you are getting. If we could get an oil briquette worked out satisfactorily it might be very simple, but I don't know whether it would be cheaper than coke. I expect it is going to be a geographical thing as far as oil and coke is concerned. In the interior coke from Alabama would probably be cheaper fuel. Now in this climate you can't leave oil in the heaters satisfactorily in the grove. There is condensation in the heaters and the oil runs over into the ground, the heater rusts badly and everything indicates they must be put away in the summer where they will be dry. If you leave them in the grove you will have oil spots which injure the soil and the heaters rapidly deteriorate.

Question: Do you have any available information as to whether or not it is easier to control your heat in the groves on the first cold night with high wind or when it is still?

Mr. Camp: You can heat much more rapidly on the still nights. I would hesitate to recommend heaters for hill top groves in this state. Large groves in hammocks or in which trees are large and keep down air motion are most successfully heated.

Question: You would not advise heating in hilltop groves?

Mr. Camp: Not unless the trees are very large.

Question: You said that fuel oil is worth five cents a gallon and wood $4 to $10. Did you mean comparing the thermal units?

Mr. Camp: Yes.

Question: Is there anybody here who fired last winter and brought the trees and fruit through without damage?

Mr. Ward: On the government station at Brooksville, we had to fire this last winter and probably fired more different nights—11 nights—in order to save our fruit in the low places. On the tops of the hills, we fired only three nights. The coldest place we had in the grove was the easiest place to fire. It was in a "pocket"—a low place, with trees on the north and west and when we lit our heaters we usually had a fairly low ceiling and it was easier to maintain temperatures than any other point. We raised with our heaters from ten to fifteen degrees. The first night of the freeze on the top of the hill where there was a large pasture area without any trees on the northwest, it was very difficult to fire early in the night because the wind was so high. The temperature went to the right point but the wind was so strong we feared damage to the trees, so we had to delay about two hours and had some damage there. In other parts where the wind was not so strong, we started firing and had no difficulty in saving the trees and fruit. We could not fire all of our grove because we had 85 acres and while we had wood we did not have enough labor so that we fired where we had the heaviest and most favorable crops and the best chance of saving it and those portions we fired three times only. We saved all the fruit. In other portions we had losses. We had to light fires for tangerines earlier than for oranges or grapefruit. What Dr. Camp said about the older trees being easier to fire is easily illustrated. The old grove where the tops came together, we could raise ten or fifteen degrees. Our fires on the northwest part of the trees we fired a little different, a number of little things, just like Dr. Camp has mentioned. One is laying fires. We found much better results by putting wood in an

"A" shape, with the point to the northeast. We had it laid so that we could start about twenty fires a minue by a fast worker. Three pieces of wood in "A" shape with the third on top and after it began burning if it burned too heavily we took off the top piece; if we wanted to raise the heat, we would prop a piece of wood on top of it. We tried to have at least nine pieces of wood to each tree every night. Nine pieces cut in four foot lengths burned six or seven hours. One thing we were surprised at. In the forty-acre grove on top of the hill we found on six nights this winter there was a difference of from 14 to 15 degrees in the top part, from the lower part. Unless you have a good thermometer you are likely to lose fruit on some part of the grove. We ran three miles of fire on the north part, two or three rods excepted, and on the south-east side we might as well not have had any fires at all. The heat would travel through and get just as warm even though ten rows back. We did not fire every pile every night. Most of our fires were on the north and west sides.

Dr. Camp: I happen to know this grove pretty well and that "pocket" has particularly young trees. I wonder how many more fires you had to burn per acre. The pocket grove happened to be eighteen years old and the young grove is next to it. In the eighteen year old trees we had about one-fourth as many fires as in the young grove.

## THE PRUNING OF CITRUS TREES INJURED BY COLD

**Leo H. Wilson, Bradenton**

I find that we have practically no data on the subject of citrus trees injured by the cold, so I wish to talk to you briefly about this subject of pruning and trust we will have a few minutes thereafter for discussion.

Our December freeze certainly left us much to do. Since then we have had a good many months' work ahead of us to clean up. The drought following the cold in December and the continued drought through the spring has done considerable damage to trees and it seems has really killed back more trees in some localities and did more harm in cold areas than the cold did in December. I notice in a number of groves I am familiar with, that, after the December cold, a flush of growth came out that reached five or six inches in length; but on account of the dry weather and no sap coming up into the trees there was no vitality there and the new growth dropped off or the late cold killed it. We have had a trying winter and I felt rather old before the winter was over. I think we had predictions of a killing freeze for about sixteen nights in succession.

All of us realize that with these cold-injured trees full of dead wood the grower has a very sick grove and it will be absolutely necessary to build up the vitality of the trees before he starts operations. The tree is considerably like the human body—the surgeons don't do too much carving on us till the system is built up. It is absolutely necessary in the pruning of trees. The vitality must be brought up to quite a good standard before we can go to cutting on trees.

As an example of this, you have probably noticed groves that were pruned early this spring that now show dead wood. Limbs five or six feet long have recently died. One good criterion for the grower is to watch the action of the trees. When he can go through the grove and not see a limb dying here and there, he can start pruning operations. Many trees that budded out and put on new growth are dying today. A lot of those limbs have bark bursted open and there is not sufficient sap flowing in those trees to give foliage the proper support.

Another example, I cut back five acres of trees of my own about the middle of February. There were 330 trees in this five acre plot. Most of the trees were in fairly good physical condition. The

crop had been all removed by December 1st. I cut this five acres back primarily for top working. I notice now in nearly every case those trees have put out new growth and look very promising to bring the desired top, for budding into. But here and there are trees I observed were weak before cutting back. They were weak from poor root-stock or heavy crop or something prior to the cold. These trees have in nearly every case (probably twenty-five of them) died back practically to the ground, or have lost a portion of the limbs I left there. To get trees ready for pruning, we need to fertilize them and we need to cultivate them. There is opportunity to use a lot of good common sense in treating the groves that have gone through this freeze and in many cases are killed clear back to the trunk. So that I urge you to watch these trees, especially those that have suffered severely. Give them nitrogen—the cheapest source of plant food you can buy.

If you can't give them a balanced fertilizer, give them nitrogen. In many cases plowing will benefit materially. Don't be afraid of cutting a few roots. It will help to bring on a more vigorous top if you apply nitrogen and have ample moisture. After our summer rains start in and we get more growth in the trees, you can begin to see the line of demarcation. It should be established by the middle of June or July, where you can make a good safe cut and not have to come back later. I fear that growers who rushed in and pruned indiscriminately have made a mistake, unless they had irrigation or ample rainfall to put vigor into their trees.

To the grower who finds trees coming back vigorously, I think those trees should be pruned. It is necessary that the trees that can stand pruning be pruned immediately. In this early pruning, it is very necessary to get ahead of the spring infestation of melanose. If you have trees such as I have just described, that are not damaged much, but with terminal branches killed back, and the center of the trees and lower branches well leafed out, and you have fruit, it is well to get busy and prune those trees, so that they may be protected from the melanose spores. If you can't get there as quickly as you would like, take to the Bordeaux spraying you heard discussed this morning.

This is a splendid time, I think, for any grower that has varieties he would like to change, to do a little top working. The grove I cut back in February was a type of undesirable grapefruit—you know how that has been selling. When this cold killed it, it didn't take much nerve to go out and cut the dead tops back. I think about half the grove suffered very little. It took a little more nerve to cut these back shoulder high. There are several methods which can be used in pruning such trees for top working. I cut the trees back into the main limbs and try to shape the tree so it will be easy to bud and easy to take care of after the buds are inserted. I even had to use a crosscut saw on some trees (because the limbs were six to eight inches through) so that I could have my tops to work more upright and more symmetrical. Another method, where your grove is killed back severely, and you wish to top-work it, is to cut it back to the trunk of the tree, three or four feet from the ground. I don't like that method on large trees. After you graft into the side it does not matter how many sprouts you may put on the large trunk, if it is twelve or eighteen inches through you will have a cavity there that will give you trouble later on. It will hold water and it will decay and become diseased. Where you have large trees killed back that bad it might be better to go to the ground and crown graft or bud sprouts. Top-working is a pruning operation. It affords opportunity to change varieties. We know that Pineapple buds on lemon root in sandy soil don't do well. The trees will overbear unless you cultivate them well. Maybe you would like to put another orange on lemon root, such as Valencias or Hamlin oranges. Now we are getting down to methods of pruning. I have known some authorities that stated about pruning a grove, just go ahead and get out the dead wood the best way you can. It is a trivial matter. Just go on with a long pole and hack it out, just so you get the dead wood out."

I expect some of you have heard that kind of advice, but I am sure a better job of pruning is worth consideration, and it rejuvenates the trees just like an application of fertilizer. The proper

method of taking out dead wood, making smooth cuts and leaving no ragged places, is worth a great deal to the health and vigor of your trees. Good pruning operation stimulates tree growth. You will see lots of inside sprouts growing and in a few weeks you can go through and pull off those sprouts. It is a good indication you have stimulated growth by a scientific operation in pruning.

In cutting back these large trees, I would like to give you another warning about the prevention of sunburn. If you wait until summertime, when you get a clump of inside growth you should have sufficient coverage to protect the trunk from inside burning. Leaving large limbs bare, you may bruise this bark and get sunburn. You can whitewash the trees or drape loosely with grass or moss and protect it until the growth can come out and get established.

I heard one grower say, and it is a good proposition for many of us who have lost wood and crops and who are not financially able to go ahead with large pruning operations, that the grove might like a little time; and if you have a grove so injured, you won't make a mistake to cultivate it. Put in a cover crop and let it go till Fall or Winter, especially if it has no fruit on it or no opportunity for putting on a late April bloom. Where the trees don't have any opportunity of coming back with a satisfactory crop, I can't see any special reason to rush in and do a lot of pruning. An idea another grower gave me is that the new growth that is coming out on the trees is protected by the old limbs in case of wind. I know that is true, because in my own trees of which I spoke, following a little shower and wind you could pick up a handful of nice shoots 18 to 20 inches long from under some trees, blown off because they had no support.

Now, if you follow the practice in pruning of making the cuts close up to the main limb or body, you at once think about what preservative these cut surfaces should have. I have noted a number down here that are being used. Maybe you have a preparation you use that is successful and economical; and any good formula you have may be used. "Savatree" is very popular in my county. I have used a little. I think it runs around $1.50 a gallon. I am not prepared to say exactly what it costs in quantity. White lead is a very common mixture that is used; it is satisfactory where you have small cuts. I have never tried it on real large cuts. Many of the roof paints or coal tar products are used very satisfactorily. I know one mixture of Texol and coal tar that has given very satisfactory results. I believe that will come a little cheaper.

I met a gentleman yesterday from Weirsdale, selling an asphaltum and wax mixture with copper sulphate as a disinfectant. I tried it out on some trees and gave him an order for some. I don't know how it will work out, but the materials he has in that product should be good. He is delivering that to me for $.70 put up in ten pound pails. His product does not weigh that much. It weighs about 6½ or seven pounds. It comes a little cheaper to buy it in drums or barrels.

I know of another product that a prominent grower in Manatee County uses. After the 1917 freeze he used a mixture to seal crevices and to paint surfaces. It was a mixture of one-third wax and two-thirds paraffin. In using this mixture, you naturally have to have heat to keep it at the melting point, so that it can be easily applied.

After you get the grove pruned and the ground is covered, in many cases, with brush, I like to urge you to take it out of the grove. I don't think it will injure anything, but it is in the way. If you are going to bring this grove back quickly, you need the brush out of the way, so that you can do the necessary work and plant your cover crop. So I don't believe I would let a large amount lay in the grove. A small amount, where your pruning is light and it is out of the way, won't hurt a thing—in time it will decay and have some benefit as humus. I find in my work, however, in taking care of a number of groves, it is best to take it out, because when I use a scythe or run a mower under the trees, a very small twig can sometimes make trouble, so I am going to take out all the limbs and dead wood that has been cut off.

Dr. Camp touched on a matter, in no uncertain terms, that I wanted to speak of, and that is in regard to not replanting or building up groves on poor sites and on poor soil types. I

think it would be a good thing to let these sandsoaks go back. I notice a large number of groves, going over the state, sometimes out of a forty-acre tract, 35 acres may be doing well, and it goes for ten years without any injury. Then the owner gets it in his head that this land next door should be in grove, too. He may put in some soil aids, but he would be better off and so would the citrus industry if he would quit planting.

One thing I did not mention and that is the type of tool, and I feel every one will use the tool he uses best. I use long handled clippers with billhook and crosscut saw.

## THE EFFECT OF THE FREEZE OF DECEMBER 12 AND 13 ON CITRUS PESTS IN FLORIDA

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Fortunately for the citrus grower, it is not very often that an opportunity is available for determining the effect of freezes on citrus pests in this State. In 1917 we made extended observations on the effect of that freeze on citrus pests. These results were published in *The Florida Entomologist*, Vol 1, No. 3. After the freeze of December 12 and 13, 1934, we undertook to determine just what effect the low temperatures had on the several important pests attacking citrus.

### CITRUS WHITEFLY

Previous records and observations following the freeze of 1917 show that the citrus whitefly is not especially sensitive to freezing temperatures. Also, this insect is found as far north as North Carolina, and it was not expected that temperatures as low as 22° F. would kill the pupae.

After the freeze of December, 1934, seedling orange leaves and tangerine leaves from the trees and from the ground under the trees were examined for the presence of whitefly pupae. The number of living whitefly pupae found on 200 each of orange and tangerine leaves is given in Table I.

It will be observed that there is a difference in the number of living pupae found on leaves on the trees and fallen leaves. This was no doubt due to adult whitefly preference for young and vigorous leaves for oviposition. Old and partially non-functioning leaves would no doubt be less attractive to the adult whitefly, but more liable to fall, especially under any abnormal condition such as drought and freeze. The presence of so many living pupae on leaves that had been injured by the freeze is most convincing evidence that the whitefly is much more resistant to cold than either orange or tangerine trees.

The data contained in the table indicate that the direct effect of the freeze on the whitefly pupae has amounted to very little, and it is doubtful if the cold killed any pupae other than those deprived of normal food supply by defoliation.

### THE RED SCALE

After the 1917 freeze observations on this scale were made on camphor trees, but following the recent freeze many examinations of this insect

TABLE I

EFFECT OF DECEMBER, 1934, FREEZE ON CITRUS WHITEFLY

| | Living whitefly pupae on | |
|---|---|---|
| | 100 leaves on tree | 100 unwilted leaves on ground |
| Seedling orange | 115 | 58 |
| Tangerine | 141 | 102 |

*Retired May 31, 1935.

were made on citrus trees in several localities where the temperatures caused severe injury to fruit and foliage.

The number of dead and living red scales found under various conditions which were subjected to a temperature of 22° F. are given in Table II.

On the severely injured grapefruit most of the limbs an inch or less in diameter had been killed. On the less injured tree very little of the bearing wood had been killed and some leaves still remained on the tree. The results from the red scale counts on grapefruit indicate that about 30 per cent. of the adult females survived the low temperatures. There appeared to be no difference in the percentage of living from the injured tree and from the less severely injured tree. The counts on oranges from the same grove in identically the same location gave a slightly greater percentage of kill. Only 5.6 per cent. survived on grapefruit foliage. These data agree exactly with the results obtained in 1917, when it was found that nine per cent. of the red scales had been frozen on camphor foliage, when the temperatures were almost identical.

THE PURPLE SCALE

Many adult female purple scales were examined in several localities to determine the effect of the low temperatures. In making the counts only recently-dead adult females were recorded as having been killed by the freeze. No actual record of living and dead purple scales were made in any particular grove immediately before the freeze occurred, but some data have been secured since the freeze which may be of interest.

In a grove where the temperature fell to 22° F., 200 tangerine leaves were examined and the number of living adult female scales found are given in Table III.

TABLE III

THE EFFECT OF THE DECEMBER, 1934, FREEZE ON THE PURPLE SCALE INFESTING TANGERINE LEAVES

| | Living adult females | Living adult females with eggs | Total |
|---|---|---|---|
| 100 tangerine leaves on tree | 91 | 47 | 138 |
| 100 tangerine leaves on ground | 46 | 51 | 97 |

TABLE II

THE EFFECT OF THE DECEMBER, 1934, FREEZE ON THE RED SCALE

| | Adult female red scales | | |
|---|---|---|---|
| | Dead | Alive | Alive |
| | Number | Number | Per Cent. |
| Grapefruit tree, severely injured | | | |
| Location 1 | | | |
| Fruit on ground under tree | 88 | 38 | 39.0 |
| Fruit on tree | 88 | 32 | 26.6 |
| Grapefruit tree, less injured | | | |
| Location 1 | | | |
| Fruit on ground under tree | 88 | 34 | 27.8 |
| Fruit on tree | 142 | 42 | 29.6 |
| Grapefruit, severely injured | | | |
| Location 2 | 100 | 53 | 34.6 |
| Oranges, severely injured | | | |
| Location 1 | 200 | 45 | 22.5 |
| Grapefruit foliage on tree | | | |
| Location 1 | 200 | 11 | 5.6 |

Further examinations of purple scales were made on fruit and foliage which varied in the degree of injury caused by the low temperatures. The results of some of these examinations are given in Table IV.

There seemed to be a slightly greater mortality on severely injured trees than on less injured ones. A greater percentage of purple scales were killed when exposed to a low temperature of 19° F. than when exposed to a low of 22° F. At 19° F. there was a most striking difference in the mortality on the leaves and on the fruit. This is perhaps due to the greater heat radiated by the fruit than by the foliage.

Since the above counts were made numerous crawlers have been observed, which shows that many purple-scale eggs were not frozen.

Following the freeze in 1917 it was found that the purple scale was more resistant to low temperatures than the red scale, and extensive examinations of both insects after the recent freeze substantiate these findings. The purple scale is much more resistant to the low temperature of 22° F. than the red scale. Examination made of the respective species in the same grove showed that 71.7 per cent. of the purple scales and only 28.5 per cent. of the red scales survived. This is about 40 per cent. more survivals of the purple than of the red scale.

### THE RUST MITE

At the time of the cold wave there was an abundance of mites present. No doubt the low temperatures actually froze some rust mites, but great numbers were also left and were present on completely frozen fruit immediately after the freeze. On December 26, 1934, counts were made of rust mites present on foliage left on the tree and on unwilted leaves that had fallen to the ground. On 25 squares counted on leaves left on tangerine trees there was a total of six adults and 18 young on the upper surfaces and two adults on the lower surfaces. On 10 squares on the fruit there were 263 mites, or an average of 26 per square. Only five mites were found on unwilted leaves on the ground. No doubt these came from eggs deposited before the freeze.

### OTHER MITES

After the freeze several living specimens of *Tenuipalpus irritans* and *Tetranychus citri* were found. It is very doubtful if very many of these

TABLE IV

THE EFFECT OF THE FREEZE OF DECEMBER, 1934, ON PURPLE SCALES

| | Low Temp. | Purple Scales—Adult Females | | |
|---|---|---|---|---|
| | | Dead | Alive | Alive |
| | ° F. | Number | Number | Per cent. |
| Grapefruit tree, severely injured | | | | |
| Location 1 | | | | |
| Fruit on ground under tree | 22 | 11 | 29 | 67.4 |
| Fruit on tree | 22 | 10 | 17 | 63.0 |
| Grapefruit tree, less injured | | | | |
| Location 1 | | | | |
| Fruit on ground under tree | 22 | 11 | 38 | 77.5 |
| Fruit on tree | 22 | 11 | 41 | 78.8 |
| Orange fruit, severely frozen | | | | |
| Location 1 | 22 | 40 | 100 | 71.4 |
| Grapefruit foliage on tree | | | | |
| Location 3 | 19 | 200 | 96 | 32.4 |
| Grapefruit on tree severely frozen | | | | |
| Location 3 | 19 | 75 | 100 | 57.1 |

were frozen. Eggs and newly hatched young of the latter species were present.

### THE EFFECT OF THE FREEZE OF DECEMBER 12 AND 13 ON THE PAPAYA FRUIT FLY

Papaya plants in central Florida were killed to the level of the ground by the freeze. In one planting consisting of about 50 plants all the fruit fell to the ground and most of it had not rotted on January 1 when the examinations to determine the effect of the freeze on the papaya fruit fly were made. One hundred fruits were cut, and 16 living and seven dead larvae were found. The living larvae were about mature and in a few days would have left the fruit to pupate in the ground. There was considerable evidence that several fruits had been infested with larvae, which had left the fruit and gone into the ground to pupate since the cold wave.

### EFFECT OF SULPHUR ON RUST MITES DURING A PERIOD OF LOW TEMPERATURES

It has been known for a long time that when citrus trees are dusted with sulfur when the temperature is about 90° F. complete mortality takes place in less than 30 minutes. In fact, the greatest percentage of kill takes place in the first 10 minutes. In practical grove work, however, examinations are made 24 hours after the dusting when the bodies of the dead mites have dried up or when most of them have fallen from the fruit.

It has also been known for a long time that when citrus trees are dusted in winter when the temperatures do not reach a maximum of more than 75° F. living mites may be found on the trees after as long as four or five days, even though the greatest mortality takes place within a few hours after the dust has been applied. Fortunately, from the standpoint of experimental work, we had an opportunity to determine the effect of dusting when much lower temperatures prevailed while the dust was being applied and for many days thereafter.

In a seedling orange grove where experimental work is being conducted it was noticed on December 6, 1934, that there were great numbers of mites present, and the grove was dusted with sulfur on December 7.

While the sulfur dust was being supplied the weather was cool and cloudy and the atmosphere was very humid. During the day the temperature was only 67° F. and toward evening it fell. Since this is the only experiment that we have ever known to be conducted under such temperature conditions, the rust mites were counted in the grove almost every day. The number of mites per square and the minimum and maximum temperatures are given in Table V.

TABLE V

RUST MITE COUNT AND TEMPERATURES, GROVE DUSTED DEC. 7, 1934

| Date | No. days after dusting | Aver. No. Mites per square | Temperatures | |
|---|---|---|---|---|
| | | | Min. | Max. |
| Dec., 1934 | Number | Number | ° F. | ° F. |
| 7 | | 53. | 48 | 70 |
| 8 | 1 | 7.3 | 35 | 53 |
| 9 | 2 | No count | 30 | 60 |
| 10 | 3 | 5.3 | 38 | 65 |
| 11 | 4 | 4.1 | 36 | 40 |
| 12 | 5 | 5.3 | 23 | 51 |
| 13 | 6 | 4.1 | 21 | 60 |
| 14 | 7 | 7.2 | 38 | 65 |
| 15 | 8 | No count | 38 | 70 |
| 16 | 9 | No count | 42 | 75 |
| 17 | 10 | 3. | 43 | 75 |
| 18 | 11 | .9 | 58 | 70 |
| 19 | 12 | .17 | 60 | 70 |
| 20 | 13 | .65 | 43 | 50 |
| 21 | 14 | .52 | 45 | 67 |
| 22 | 15 | .4 | 45 | 71 |
| 23 | 16 | No count | 42 | 72 |
| 24 | 17 | .25 | 50 | 75 |
| 25 | 18 | No count | 55 | 76 |
| 26 | 19 | .08 | 58 | 77 |
| 27 | 20 | No count | 56 | 76 |
| 28 | 21 | .02 | | |

It will be seen there was a high percentage of mortality immediately after the sulfur was applied, but there was little or no mortality during the low temperatures. In a good commercial control it should be impossible to find a single rust mite for two to three weeks after treatment. This is the only time we have ever observed living rust mites in the midst of sulfur. Even though this experiment is largely the result of accident,

we consider it one of the most important pieces of work we have ever done at this station.

Orlando, Florida, March 8, 1935.

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Mr. Yothers: I would like to say a few words on the control of scale, which I did not get to this morning.

Mr. Taylor: We will be glad to have you do that.

Mr. Yothers: One of the things we must remember, as growers, is that it is very difficult to get a spray program here in the state, because of the fact that when you get a program for the control of a fungus disease it works against the control of the insects, flies, etc., so many, many years ago we built up a spray program with the entomogenous fungi as the center of the program. I believe now that the presence of these fungi in Florida is one of the main reasons that we can grow oranges here so inexpensively compared with other places. It is because our scale and whitefly and other insects are all attacked by these fungi.

When fungicides are used for the control of these diseases such as the gentleman mentioned this morning, they are used, as you know, in the spring of the year, practically always, and that is the time of the year when the entomogenous fungi are not very active. So since the use of these fungicides throws the natural balance out of line, the thing for us to do is to get a program to follow up after the applications of these fungicides, just as soon as possible. We find that if any fungicides have been applied, the best time to apply any scalicide is around the last few days in June or the first week in July, as that is the time when the greatest numbers of scales are present in the crawler stages, and a dollar spent during this period brings many times the results that a dollar spent at practically any other time during the year.

We agree with Mr. Thompson and others that scales can be very easily controlled at this period if lime sulphate solution, 1 to 50, to which is added five pounds of wettable sulphur, is used. This wettable sulphur sort of peps up the lime sulphur solution and does not increase in any way the liability to damage. I believe a combination like this, applied most thoroughly and during this period, brings almost perfect results for scale control. Then, after this application, the rains come and the fungi take care of the scales and a good many insects during the balance of the year.

I do not have much else to say, excepting that a year ago—you will be glad to hear this, I guess—Dr. Phillips had an airplane dusting and they dusted forty of fifty acres in less than half an hour. I mention this because it was a much better demonstration than what we saw yesterday. The man didn't have a fair show yesterday, because he could not put the sulphur on the east side where the main grove was, because it would dust the people in the cars. I believe that's all I have to say about control of scale.

Question: With reference to the fungi which begin to operate in the wet part of the year, if you used Bordeaux after the first spraying, wouldn't you do away with those fungi?

Mr. Yothers: Theoretically, yes, but as a matter of fact it is almost impossible to rid the grove of these entomogenous fungi. I don't believe I have ever seen a grove completely rid of them.

# THE EFFECT OF FREEZING ON ORANGES

**W. Y. Gary, Ocala**

Following the unusual weather conditions of December, 1934, the Citrus Inspection Bureau was confronted with problems concerning frozen oranges. It was therefore decided to undertake research work on the effect of freezing on oranges with the hope of finding some better methods of determining the extent of damage to oranges as a result of freezing. I was asked to do this work which was carried on at Winter Haven Laboratory of the Citrus Inspection Bureau. The details of this investigation are given in the publication of the Chemical Division of the Florida Department of Agriculture dated March 1, 1935, and entitled "The Effect of Freezing on Oranges."

In order to attack the problem systematically it was decided to perform a controlled experiment and then to follow this with a comparison with natural conditions. Accordingly, it was decided to freeze samples of oranges artificially and test them at progressive intervals after thawing. All the oranges in each sample were from the same tree in order to exclude errors due to natural variations. There were 24 oranges in one sample and 16 oranges in each of three samples. Each sample was divided into lots of eight oranges each. One lot of each sample was kept in the laboratory at room temperature to serve as controls. One of the lots of the 24 orange sample was subjected to a temperature just a little above freezing for about 12 hours. The other lots were frozen. One sample was analyzed one day after thawing, another three days, another six days, and the last eight days. In each case the corresponding control was analyzed at the same time as the frozen lot.

The analysis of the chilled lot of the sample mentioned was found to be practically the same as that of its control and will be excluded from further discussion. The differences found between the frozen lots and their controls are, therefore, concluded to be due to the freezing and thawing process and not the effect of the cold alone.

The observations made and the results of the analyses of the experimental samples and the comparison with natural conditions are as follows:

The frozen oranges contained small white specks in the pulp and segment tissues. These white specks are small crystaline aggregates of hesperidin, a compound normally occurring in oranges. They have been observed by most growers in oranges frozen on the trees. Their presence has sometimes been used as a test for frozen oranges but no evidence has been found to indicate that all oranges containing hesperidin crystals are unfit for use as a food.

The pulp of the frozen oranges had become lighter in color. The cut surfaces of the peels of the frozen oranges were darker than in the controls. The pulp of oranges frozen on the trees showed a similar bleached appearance as was observed in the artificially frozen samples.

As most of you know, when water changes to ice there is an increase in volume. When the water in the juice freezes it expands and thereby bursts the walls of the cells in which it was contained, and on thawing the juice seeps out. This accounts for the mushiness of the frozen samples. This mushiness was frequently observed, in oranges frozen on the trees.

The frozen samples began to rot after six days after thawing. The breaking down of the cell walls, as just explained, probably aided the spreading of the organisms causing the decomposition. Oranges frozen on the trees did not generally begin to rot as quickly as our experimental samples.

When strained juice from the control samples was allowed to stand an hour or more a distinct sediment was formed at the bottom of the liquid. Strained juice from the frozen oranges formed a less compact sediment. The longer the fruit had been kept after thawing the more buoyant was the effect on the insoluble particles until in the sample kept eight days after thawing most of this material floated to the top on letting the juice stand. It was also observed that much of

the insoluble matter in juice from oranges frozen on the trees acted in a similar manner to that of the experimental samples.

In comparison to the control samples there was an abnormal loss of juice from the oranges which had been frozen. This amount became progressively larger and larger as the time increased after thawing and averaged slightly more than one per cent. for each additional day. This loss of liquid is accounted for by the breaking down of the cells which allows the juice to seep out toward the skin where evaporation takes place. Most all grove owners have noticed the drying out of frozen fruit. This drying effect has been of much concern and will again be mentioned.

There was an immediate drop in per cent. of citric acid in the juice after thawing. The change in pH corresponded generally with the change in acid concentration. This lowering of the acid concentration was distinctly noticeable when oranges in the frozen part of a grove were compared with the same varieties from parts of the grove not frozen.

The quantities of total sugars in the juice of oranges having been frozen were not appreciably affected. The per cent of sucrose was decreased but the invert sugars were increased. There was also no significant change in the total soluble solids of the juice. The loss of acid was, therefore, responsible for the increase in total soluble solids to acid ratio in the frozen oranges. In most cases it was observable also that the ratio had been increased in oranges frozen in the groves by nature. The ratio test has been suggested as a test for frozen oranges. This, however, could not generally be used because in practical work we find that there are other factors which alter the ratio beyond the limits of change caused by freezing.

An estimate of the Vitamin C content was made by means of the Iodine Titration Method which has sometimes been used in studying the Vitamin C content of citrus juices. This method indicates that there is no loss of Vitamin C from oranges as a result of freezing or changes taking place within a reasonable time after thawing. In testing oranges naturally frozen no reduction in Vitamin C, as determined by this method could be noticed.

A question of vital importance regarding frozen oranges is whether or not the eating of such fruit is detrimental to health. For a while there were a number of reports that eating frozen oranges had made people sick. The harmless effect of eating frozen oranges was demonstrated as follows: Valencia oranges were picked on February 7th, frozen artificially over night, and then kept at room temperature for three days. The oranges then bore the usual signs of having been frozen. One volunteer drank as much juice from these fruits as contained in three average sized oranges, another as much as in two, and three others as much as in one orange each. None of these people had any digestive disturbance as a result of this experiment.

For some time a firm in the North sold frozen orange juice for home use. There is no evidence that this juice made anyone ill because of the freezing process.

Since December, 1934, I have talked with a number of people who have knowingly eaten frozen oranges and they have declared that eating such fruits had no ill effect on their health. There are many others who have been eating frozen oranges, without realizing that they had been frozen, and yet there seems to be no complaint that they had been made sick for this reason. Of course, in these cases the instances where decomposition had set in are excluded.

It has thus been shown that freezing does not in itself make oranges detrimental to health. It was also shown that freezing does not decrease the food value of a given amount of orange juice. However, the total amount of juice per fruit was shown to be lowered. To offer dry oranges to prospective purchasers is a deception, for Florida citrus fruits are expected to be juicy. Tests made in the Citrus Inspection Bureau Laboratory have indicated that oranges containing less than 43% juice by volume, when the juice is determined by hand squeezing of unpeeled fruits, are unduly dry. Therefore, should it be desirous to enact some regulatory measure for the shipment

of frozen oranges, it seems that the most practical standard should be based on the juice content. With this restriction it is seen that the growers whose oranges have been affected by freezing make at least a partial saving without putting any bad fruit on the market.

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# FOUNDERS AND FOUNDATIONS OF FLORIDA AGRICULTURE
## A Serious and Frivolous Study of Men and Measures

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**P. H. Rolfs, Gainesville**

*President Taylor of the Florida State Horticultural Society; Ladies and Gentlemen:*

I am proud to stand before you today, to contribute in some degree, however small, to your enjoyment of this occasion. We have each come here to add our mite and take away something inspiring and valuable. I have never missed a meeting since the Ormond meeting in 1892, when I have been in the State. I have always carried away more than I have contributed. The noble, splendid men and women of the Florida State Horticultural Society have always been an inspiration to me.

The preparation of this paper has been a great pleasure to me. Pleasures are contagious. I hope that you will enjoy hearing it a fraction as much as I did preparing it.

### FRUIT GROWERS LONG LIVED

Last year the American Fruit Grower announced the official formation of the Fifty Year Club, to commemorate the magazine's Golden Jubilee. The Club consists of persons still living who had dedicated fifty years personal service to the business of fruit growing. Fifteen of the 181 charter members resided in Florida. They are: (1) J. B. Booth, Tavares; (2) A. H. Brown, Manatee; (3) S. P. Brantley, Clermont; (4) Joe Carson, Babson Park; (5) J. C. Chase, Winter Park; (6) J. B. Curtis, Orange Heights; (7) B. M. Hampton, New Port Richey; (8) W. S. Hart, New Smyrna; (9) T. A. Hux, Tavares; (10) A. S. Matlack, Sorrento (since deceased); (11) John B. Oberholzer, Esmeralda; (12) L. B. Skinner, Dunedin; (13) H. B. Stevens, DeLand; (14) E. L. Wartman, Citra (since deceased); (15) W. D. Yonally, Grand Island.

Theodore Meade, Oviedo, and possibly one or two others should have been included.

You see, I am not quite old enough to be among the immortals; in other words, I am just middle aged; in my opinion. Any one younger is not quite middle aged, really not quite old enough to be taken seriously.

### HORTICULTURAL LEADERSHIP

A second page of the American Fruit Grower is dedicated to Fifty Years Horticultural Leadership. This contains thirty-five who were too young to be in the Jubilee Club; twelve of these have had a marked and potent influence on Florida Horticulture. They are: F. V. Coville, R. H. Dorsett, David Fairchild, B. T. Galloway, L. O. Howard, H. Harold Hume, Charles L. Marlatt, P. H. Rolfs, William A. Taylor and H. J. Webber. Fairchild, Hume and Rolfs reside in Florida.

F. V. Coville's efforts in domesticating the blueberry are a notable piece of work. P. H. Dorsett saved the Subtropical Laboratory when it was being dismantled. David Fairchild has an undying monument in the introduction of thousands of the plants we are growing. B. T. Galloway, in organizing the Bureau of Plant Industry, fought to have the crop recognized as the unit on which investigation should be centered. He lost, but now the Department of Agriculture is attempting a second time to organize on this basis. L. O. Howard, as head of the entomological work, opposed the co-operative ideal and won. Both, as heads of their respective labors, did

splendid work in their own way, for Florida. Hume and Florida Horticulture are synonymous. Marlatt has done splendid work for Florida in pest regulatory work. P. H. Rolfs has been with you always. Taylor has contributed technical descriptions of numerous of our fruits. Webber ushered in a new era for us in combatting citrus pests. With Swingle he started citrus hybridization.

### THIS ADDRESS, SERIOUS AND FRIVOLOUS

This brief paper is a sort of "Who's Who and Why, Among the Near Great in Florida Horticulture." Serious and frivolous. "Lest we forget" the forgotten men among the makers of Florida Horticulture. The historian will be able to reconstruct a fair picture from our Annual Proceedings and other contemporary publications. There are many side lights and unrecorded incidents, hunches, or whatever you may call them, that never got into print. Often, apparently irrelevant incidents determine the success or failure of an entire industry. In a measure I am interpreting the meaning and effect of some movements not recorded on the printed page. Some of the glimpses I am recording, I hope may be useful to an historian, to enable him to construct a clear picture of the history of Florida Horticulture and Horticulturists. It is largely a reminiscence of forty years in Florida Horticulture. Secretary Floyd asked for it: So here it goes.

### WHO MADE FLORIDA GREAT?

I am not unmindful of the very important role played by the transportation interests in augmenting volume. I am not unmindful of the part played by the great fertilizer manufacturers in augmenting production. I am not unmindful of the splendid and untiring labors of civic organizations in securing the presence of winter visitors. I am not unmindful of the nurserymen who made it possible to plant extensive groves of the finest varieties. All of these could not have produced a Florida without the *orange tree*. The orange tree put steamers on the St. Johns River. It was the lodestone that drew travel to the Tampa Bay; to the Ponce de Leon; to the Royal Poincianna. The orange tree, always beautiful, always inspiring. The delicious perfume of the bloom. The delicate waxy petals are the ambition of the bride. The lush spring and summer growth fills the grower's heart with contemplation. The balls of gold foretell the harvest. When the Lord created the orange tree, He called it a day. He has not attempted to improve on it.

Reminiscences easily become "remi-nuisances." "Reminiscences are the nurseries in which children grown old, play with broken toys."

If you are not mentioned in these ramblings, that is your fault for being alive, and if you happen to be among the "dead ones" you would be overlooked anyhow.

### THREE PERIODS

This paper will be replete in anecdotes, irony and sarcasm, possibly. For tonight's purposes we may divide Florida Horticulture into three periods: (1) B. C. (Before Coming); (2) A. D. (After Doing So); (3)Cenozoic (The Age of Voluminous Printed Matter). The first period (B. C.) ended in 1891.

All the books published on Florida Horticulture up to that date can easily be held between my thumb and fingers. This period found three young men who were the sole representatives of the Bureau of Entomology, the Bureau of Plant Industry and the Florida Agricultural College. These organizations now have a hundred or two hundred men and women employed in Florida. The State Department of Agriculture was timidly knocking at the door of Florida Horticulture for admission. H. G. Hubbard, Entomologist for the Division of Entomology, had just invented the emulsifying of kerosene and soap. (For which someone else got the credit.) Swingle had been sent to the state by the Division of Plant Industry, to subdue orange blight—through the influence of Senator Platt of New York, whose wife owned a grove near Leesburg, badly afflicted with that disease. Your speaker was Entomologist and Botanist to the Florida Agricultural Experiment Station and Professor of Natural Sciences in the Agricultural College, which studies ranged from Entomology, through Geology to As-

tronomy. "There were giants in the land in those days."

The A. D. period merged rapidly into the Cenozoic period which was marked by voluminous and splendid publications. One author alone, Hume, has already published an armful of books and will publish another armful by the time he reaches "middle age."

### TWO GROUPS

For the convenience of this paper and your comfort, I have divided the forgotten horticulturists into two major groups—those I have not known and those that I have known. It is this latter group that we will pass in review tonight.

### ENTER PRAGMATISTS

In the B. C. period all necessary problems in orange culture had been solved. An authority says so, in so many words. The Florida Horticultural Society was a mighty youth who had just entertained the great Pomological Society, 48 years ago. Adams, Rev. Lyman Phelps and W. S. Hart were among our outstanding leaders. We youngsters were horticultural pragmatists. We knew nothing about subtropical horticulture—and knew that we did not know. We were from Missouri and had to be shown. We dared to call on the wise old heads to prove their theorems. Mind you. We adapted ourselves to the environment but basically remained pragmatic. Dudley W. Adams made caustic and cynical references to us in his annual addresses. Rev. Lyman Phelps, the vitriolic, and he was a master of rhetoric, squelched an attempt to extend a cordial word to the Experiment Station. W. S. Hart could always be depended upon for kindly constructive criticism. He was frequently nettled by our youthful incredulity. Sometimes he proved us wrong.

### PROVE ALL THINGS

In 1893 the presence of the San José Scale at DeFuniak, was determined simultaneously by Prof. H. G. Hubbard for the Bureau of Entomology and by myself for the Experiment Station. The Experiment Station, under Director Clute, started out to exterminate the pest. It was a losing fight. During the latter part of the next year a report came to me that trees in a certain peach orchard were quite free from the scale. Our field notes showed it was one of the first and worst affected. I spent months, at intervals, seeking the natural cause. Locally the people of DeFuniak Springs ascribed it to the wonderful climate. It looked to me as if the dictum of the spiritualist was going to come true. He affirmed that if we forgot all about the San José scale, there would be no scale. That it was all in our minds. (See also F. P. Henderson, under Deciduous Fruits.)

Chemical Analysis as a Guide. Analysis of the soil as a criterion for productivity was then in vogue. In the late 90's a private chemist advertised his ability to analyze the soil and predict therefrom whether the soil would produce a remunerative crop or not. Even so late as in the present century, a few were using this as a criterion. (The Hilgard tests for soil fertility). I remember one case where the analysis had been unavoidably delayed for some weeks. When the report on the analysis was made, the scientist remarked: "Absolutely unsuitable for any agricultural purpose." The Dade County tomato grower who paid for the analysis had already banked $150.00 per acre from that land. In those days the "whisper phone" functioned from Cutler to DeFuniak. This incident put all chemists in "A" grade in a large class of theorists.

Bean recommended Eureka insecticide as a cure for orange blight. He claimed to have had effective results from its application in liberal quantity. It was a double barreled recommendation. If it was adopted it would be highly remunerative and also would rid the commercial men of an annoying government plant pathologist. (See also Bean and Swingle, under Citrus.) So far as I know the suggestion has never been followed up. I wonder if there might not be something in it. One never can tell.

Way along in the '90's when everything was in a formative state, we were discussing the best kinds of clippers for citrus. Hollingsworth from Polk County gave us a great tirade on pulling oranges and grapefruit. He was so overwhelmed by the clipper men that he quit the meeting in a fury and said some words more forceful than

poetic. He was vehement for pulling oranges and grapefruit and got properly "sat down on." He went home and published his own horticulture.

Now in April, 1935, comes the surprise. Prof. Winston, Horticulturist, Department of Agriculture, announces that pulling grapefruit instead of clipping it gives less stem-end rot. Prove all things!

In 1889 a bulletin, lavishly illustrated, containing much valuaable information, was prepared by Dr. J. C. Neal. For want of reference literature he erred; classifying the root-knot worm as *Anguilula* in place of *Heterodera*. Scientists accorded him full membership in the "Ananias Club." Investigation of the effect of *Heterodera* was "taboo" for a whole generation. Along comes a young scientist and rediscovers that *Heterodera* does cause a citrus disease. Prove all things!

### THE FOUNDERS WERE INDIVIDUALISTIC

The makers of Florida Horticulture were strong individualists as distinct from collectivists. They would co-ooperate with the scientists as individuals to the "nth" degree, but as a community or an organization they "fought shy" of doing things collectively. This made them and the industry easily subdued by the transportation interests. It laid many of the growers open to exploitation for private gain.

The epoch making discoveries and progress have been made by individuals rather than by groups working collectively. This underlying motive is strong in the easterner as distinctive from the westerner. The easterner raises the great bulk of deciduous fruits in the United States but it is the Pacific Coaster that distributes fruits to the cities and hamlets of South America and competes on the European markets with all comers. He even competes with the countries south of the Equator during their shipping season for citrus fruit.

The leaders in Florida Horticulture were drawn almost entirely from the east. Adams, Vermont via Iowa; Taber, Maine; H. S. Hart, Vermont; F. G. Sampson, Massachusetts; Rev. Lyman Phelps, New York State; later some recruits came from the West; Swingle and Fairchild from Kansas; McCarty and Rolfs from Iowa; Webber from Nebraska; McQuarrie from Scotland via Indiana; Krome from Illinois. Those of you who heard Dr. Fairchild's masterly address yesterday before the Krome Institute, will know at once that he was running true to form.

### FATE—WHO IS SHE?

Fate is a determining force whose motivating incidents are not clearly delineated. For today's allegory we may represent her as a lovely young secretary, playing "solitaire"; allocating cards in the files of human affairs. There is nothing supernatural intended; although each one of us has such a handover inherited from countless generations of ancestors. This submerged superstition in our subconscious plays for us an infinite number of pranks. I have a hunch, I play it, I am successful, it is permanently filed away in my subconscious. I play on a hunch, it proves negative, my subconscious erases it. Fate is merely the outward expression of man's adaptation to his physical and social environment.

During the late '80's we had political and social upheavals. The assassination of President Garfield; depression; over production; election of Cleveland, a free trader; bitter strikes of railway employees; other social disturbances. In the early '90's the U. S. troops were called to protect mail in transit. It was a period of social readjustment. Enter citrus industry.

*Fate and Men.* She drew her cards, located Dudley W. Adams at Tangerine; Rev. Lyman Phelps at Sanford; the Reasoner Brothers at Oneco; E. H. Hart and E. S. Hubbard at Federal Point. They were the strength and builders in the citrus industry. Taber at Glen St. Mary to propagate deciduous fruits. They were all strong individualists—had to be, to carve a competence out of a wilderness. Their names are luminous in the annals of our Horticultural Society. Scores of others, more able, wealthier, became luminous and then faded. Not these.

In '92 I discovered that a certain Sclerotium producing fungus was the cause of extensive tomato blighting. In '93, my Director of the Experiment Station permitted me to absent myself from college classes to perform some field experiments, but there was no money to pay trav-

eling and other expenses. In my experiments at Grand Island, potassium sulphide and ammoniacal copper carbonate proved most successful and economical.

Now Fate slips in. Saccardo, the world renowned Italian mycologist, whom I had never seen nor even corresponded with, called the fungus *Sclerotium Rolfsii!!!* Think of it! Devoting my life and energy to protecting plants against diseases and then have it linked in literature and possibly in history with one of the most omnipresent pests in the whole tropical plant world!

*Fate and a City.* She plays her pranks with cities as well as with men. Archer was once the center of extensive peach and truck growing. She produced such notable men as Dr. F. G. Pearson, President of the National Audubon Societies; Dr. A. L. Quaintance, recent Assistant Chief and often Acting Chief of the Bureau of Entomology; the late Sam Fleming, Assistant Director of the Florida Experiment Station. All three of these hunted birds' eggs there. Kerr, extensive trucker in eggplant, cucumber and snapbeans. I visited him because he was the "most extensive eggplant grower in the State." A. F. Wyman, who carried this knowledge to the Manatee. Dr. J. C. Neal, second Entomologist to the Florida Experiment Station. Rev. Jas. P. DePass, second Director of the Experiment Station. What was it that made Archer become luminous and then fade out? I have often wondered. Some LeConte trees, about forty years old, are still flowering and fruiting. Climate and soil are favorable.

*Fate and Politics.* Ofttime remote incidents have had a profound influence in the development of our Florida Horticulture. These are likely to pass unnoticed and the results are ascribed to Fate. Some of these were important, if not determining factors, on our Horticulture. I have already referred to the pioneer hoticultuists as coming from the individualistic East. For the most part our leaders were Republicans and hence unclean in the eyes of our Democratic Legislature. Hearty and sympathetic co-operation did not exist. A sympathetic Republican U. S. Secretary of Agriculture was checkmated by our Democratic Senators and Representatives. The freetrade Democratic administration threw our truck and tropical fruit growing into the doldrums. These influences were remote and yet exiled many an able Florida Horticulturist to the tropic isles.

### OUR HORTICULTURAL CROPS

The distribution of Florida horticultural crops has been more or less regional. This was more by fortuitous sociological circumstances than from physical causes, if we recognize transportation as a social condition. Inadequate distribution of the product has often been an impediment. The introduction of the automobile and truck has relieved this situation to some extent.

One does not have to seek far to find localities greatly favored by nature which, nevertheless, have made dismal failures of an appropriate crop; another locality far less favored by nature making an excellent success of the same crop. Why?

### A GENERAL ASPECT

In this section I want to discuss some of the factors and persons who influenced the development of Florida Horticulture in a general way rather than through some particular horticultural crop. Some factors and persons have had a very profound influence on our horticulture and that were broader than horticultural.

My deductions have been drawn from forty years experience as an active member of the Horticultural Society. Forty years of marvelous progress in human affairs. By studying the ultimate element, the individual, we arrive at a clearer understanding of the "mass behavior." It is a want of "collectivism" that has made so difficult an orderly development of Florida Horticulture. Our individualistic behavior has made us especially vulnerable to "booms and depressions." The northern portion of Florida was populated mainly by individuaals from other southern states. It made them exceedingly vulnerable to dominance for private gains, hence the dying out of peach and pear production. (The transportation and sales dominance.)

During the '80's and early '90's we had a reign of political brigandage. The office was secured for private gain; not always; there were notable and noble exceptions. No wonder the staunch men composing the Horticultural Society would

have nothing to do with anything that savored of politics. Many times we erred in failing to support measures that would have made for a more orderly horticulture. But more frequently we did well in withholding support from schemes that appeared to be sound but later proved to be detrimental to our horticulture. Rarely did we as a Society, "pull a chestnut out of the fire." Individually, frequently.

A hundred places in the state might be named that were "boomed" dry and then left stranded; some returned to the "primeval forests" from which they had been wrested. Scores of other places have grown and prospered without ever having been "boomed." Why?

### NINE LEADERS IN GENERAL

In commenting on the individuals who were directly or indirectly actors in the development of our horticulture, my motive is to make a record of their doings. I have only the kindliest feelings for their memory. Nor do I claim any superiority of intellect; a superiority complex; my "inferiority complex" has often been an inhibiting factor. No one else in the forty years has had a better opportunity for a "close-up" of the horticulture from Pensacola to Key West, so intimate contact without being a part of it. A sort of airplane reconnoissance.

PERRINE, HENRY. He had gotten a grant of land from Congress on the Keys and mainland, far south of Miami, in the early days of the last century. His assassination by Indians cut short a noteworthy project. Some of the plants he introduced maintained themselves into the twentieth century. In one of his reports he said: "The sterility of the soil is made up for by the fertility of the atmosphere." (Quoted from memory.) Perrine did not realize that he was the precursor of a numerous progeny of atmospheric boosters.

KOST, J., M. D., LL. D. Director of the Experiment Station, probably from 1888 until about Jan 1st, 1889. There seems to be no definite record of his having been elected or discharged, but his name occurs on Bulletins 1, 2 and 3. I had the pleasure of meeting him at least once, in 1892, I believe, during the meeting of the American Association for the Advancement of Science. The general reputation among my acquaintances at Lake City in 1891 and 1892 was bizarre; more adapted to an adventurer than a scientist. He had secured a charter from the Legislature to establish a private institution at Tallahassee under the name of the University of Florida. A brick two-story building, looking very much like a residence of some twelve fair sized living rooms, was repeatedly pointed out to me as Kost's University of Florida. From some printed matter that came into my hands, it would seem that at one time three or four students in medicine had been enrolled.

He had made a collection of fossils, mainly from phosphate mines, which he took east with him upon leaving Florida. These arrived at their destination in a badly broken condition. Through his astuteness he was awarded a considerable damage from the transportation company, by the court. This was most remarkable for that day. He left in a shed a model of a geologic turtle shell, some ten or twelve feet long and maybe six or seven feet broad. My, but that was a wholloper!!!

Well, when I met the doctor and had a chat with him, he proved to be all that the Lake City friends had promised "and then some." I must have been a regular life-saver to him, with all of that bile pent up in his system, he must have been at exploding pressure.

Now comes the astonishing note, for in "Science News Letter" for March 30, 1935, it is stated, "There were marine turtles over ten feet long in the North American inland sea, 90 million years ago." Maybe the Doctor was not as batty as we thought.

Bulletins Nos. 1, 2 and 3, published with Kost's name as Director, and No. 4, the first published by the Rev. Jas. P. DePass as Director, showed able scientists as contributors and presumably on his staff. Col. J. N. Whitner, Agriculturist; William H. Ashmead, Entomologist; A. H. Curtis, Botanist; J. M. Pickell, Ph.D., Chemist; George Troup Mexell, M. D., Veterinarian. A list of unusually able men for an Experiment Station staff of that day.

DEPASS, REV. JAS. P., Director of the Florida Experiment Station from 1889 to 1893. A South

Carolinian, he brought with him the proverbial pugnacity and political astuteness.

How he became Director: When the time for nominations to state offices was approaching, he announced for State Superintendent of Public Instruction. The incumbent wished to succeed himself but saw a bitter campaign ahead. He was Ex-Officio President of the Board of Trustees for the Agricultural College. Friends of the Reverend gentleman intimated to the incumbent that the matter could be smoothed out by making the Rev. DePass Director of the Experiment Station with an equal salary. That solved the difficulty and only one candidate for State Superintendent was up for nomination.

He was bold and aggressive, pugnacious, lacking in scientific training and practical experience. Apparently none of the staff that had functioned under Dr. Kost continued in service excepting Dr. Pickell and Col. Whitner.

The period up to 1893 was a hectic one for the College and for the Experiment Station. And yet some good agricultural men, like Dr. A. L. Quaintance and Sam Fleming, arose. Other figures like Rear Admiral Hutch Cone and Congressman Joe Sears have given good accounts of themselves.

Clute, Dr. Oscar, M. S., LL.D. President of the Agricultural College and Director of the Experiment Station, 1893 to August, 1897. He came to the state the best equipped man by training and experience that occupied that dual position. Before coming to us he had served his Alma Mater, the Michigan Agricultural College, as President and Director. He came in the prime of life and health. He left completely broken and died only a few months later. He was of pure Dutch stock and so killed himself licking the other fellow. Politics could not down him, but the "whisperphone" inflicted a mortal wound.

The original, life-tenure and self perpetuating Board of Trustees proved to be unsatisfactory and was abolishd. The new Board of Seven, all appointed by the Governor, contained such eminent men as W. D. Chipley of Pensacola, Judge Gwynn of Sanford, Dr. Stringer of Brooksville. Their first acts were sufficiently sensational. They elected Oscar Clute, a Michigander, over "sixteen native sons." Dr. Clute at once set out to put the College and Experiment Station in order. He aided the West Florida deciduous growers in their contest with the San José scale; he aided the South Florida tropical fruit growers at Ft. Myers (the East Coast was still largely homestead lands). His experiments transformed the velvet bean from an ornamental into a forage plant and a cover crop. He sat as referee, on the rostrum at the Gainesville meeting of the Florida State Teachers' Association. In short, he vindicated the new Board completely.

To me it was a great inspiration to work for and with such a Director and such a Board of Trustees. In 1905, a radical readjustment occurred by the enactment of the Buckman Bill. (See Wartman.)

Bryan, Milt. During the transportation tyranny, industries and communities were suffocated. Milt Bryan from Lake County and Chairman of our first Railroad Commission, believed that the shipper had some rights. They could not smother Milt Bryan, so the "interests" had the Commission abolished. Later the "square dealers" created a second Commission that has functioned to the present. While he lived in Lake County, I know Bryan only in passing; later in Osceola County I had the pleasure of visiting at his home. Sturdy, honest to a fault, a man of clear understanding of the needs of Florida and about twenty years ahead of the time in which he lived.

The best thing that he did for Florida was to raise a family of worthy sons and fine daughters. Son Will was elected to the U. S. Senate, but died from typhoid fever soon after. Son Nathan was Chairman of the Board of Control during the turbulent times when our system of higher education was being reorganized. His keen judgment and masterly understanding of Florida law successfully guided the Board of Control through that difficult period. The present greatness of the University and the splendid College for Women, are monuments to his untiring efforts. (See also, Wartman, under Citrus.) Modest, unassuming and retiring, he was always embarrassed when merited honors were thrust upon him and always enjoyed it immensely when others who merited it,

received applause. He could not do otherwise; it came to him by inheritance and home training.

To my mind, Nathan Bryan is the ideal of a statesman and judge.

POWELL, G. HAROLD. With his two young assistants, Lloyd Tenny and J. B. Rorer, he made a visit to the state about 1903, ostensibly to study citrus growing, really to see what collective co-operation he might expect from the Florida citrus growers. The Bureau of Plant Industry, B. T. Galloway, Chief, had just organized a systematic study of the citrus fruit problems. In 1909 I visited the Pacific Coast and saw a co-operative packing house, the first established, dedicated to the successful work of Prof. Powell, although he was still living.

His work had a far reaching influence in shaping the collective fruit business on the whole Pacific Coast. One finds Pacific Coast apples and pears for sale in almost every hamlet and town in Brasil. But never a one from the individualistic East.

We missed a good bet when we passed up G. Harold Powell.

GAITSKILL, S. H. After the '94-'95 disaster, S. H. Gaitskill planted a hundred acre orange grove for the Elder Dempster Fruit Company, at Port Antonio, Jamaica. I saw the grove in 1901. The trees had made magnificent growth, but no fruit had been shipped. Too much moisture and too frequent rainfall; oranges and grapefruit need a period of retarded development to produce abundant bloom and to hold the newly set fruit. Mandeville, within walking distance, in a rather sterile, dry region, produced quantities of excellent fruit. The London Office judged that all Jamaica was a good citrus producing region.

Gaitskill was a good orange grower, an excellent truck grower (by necessity), and at heart a livestock man. He was a Kentuckian, so of course, loved livestock.

He was a powerful leaven for diversification in Marion County. I enjoyed his frequent and unobtrusive visits to the Experiment Station and Agricultural College when they were in a formative state. Many of my colleagues were irritated by his rapier like sarcasm. It did a great deal to keep our specialists from going off on visionary tangents.

HASTINGS, H. G. In a modest way he started a seed business at Interlachen. He also started a paper called the "Ruralist." Both were prospering nicely when ill-advised legislation made it imperative that he move out of the state. The legislation was intended to curb some spurious seed and plant businesses that had sprung up, but it overshot the mark and hit also legitimate and honorable business. A little more care in drafting the legislation might have saved this meritorious business to the state. At the time of his transfer, he was Secretary to the Horticultural Society, which guarantees that he was doing a straight business. He has made a marked success of his business in Atlanta, Ga.

PAINTER, E. O. A fine leader, an excellent organizer, a sound promoter. The life of the Horticultural Society. A Philadelphian by training and probably by birth. Although a Baptist by profession, he was a Quaker by nature. In my long and intimate association with him, I never heard him utter an unkind word about others.

He never failed to carry off some pleasing stunt at our Annual Meetings. One of the best ones was our visit to Cuba, after the first Miami meeting, in 1912. His aids to horticulture were many and unobtrusive. He provided the money which enabled Professor Blair to install the first four tanks for the lycimeter at the Experiment Station. They are still functioning.

His will provided for the publishing of a book on truck pests and diseases by the Experiment Station. He was the one commercial man in the state who used the Experiment Station to advance horticulture rather than to promote sales. Only a short time before his untimely departure, we visited a cantaloup field in Marion County where the fertilizer had given disappointing results. My judgment was that the fertilizer was at fault. Painter settled up in favor of the truck grower. Checking up later, it was found that by an inadvertence, the truck fertilizer had been dispatched to a cotton planter in Madison County and the cotton fertilizer had been shipped to the cantaloup grower. "Q. E. D."

Painter was a printer by profession, a citrus grower as a hobby and a fertilizer man as a di-

version—I almost said by accident. He experimented with "chemicals" on his own young grove; results most pleasing and economical. Neighbors got him to order for them. Presently he had built a lean-to shed and provided a shovel; a mixing plant in embryo. The project being based on field results, grew amazingly, beyond the capacity of DeLand. Jacksonville was the logical headquarters. By that time the "Florida Agriculturist" plant grew into the E. O. Painter Printing Company." This he left in competent hands; it is still functioning. An ordinary man would have regarded it as a life's ambition fulfilled.

Speaking of printing, that reminds me of the many deserved compliments that have been paid to our unique printed Proceedings. Printing is and always has been, a bugbear, passed up to the Executive Committee, fortunately.

On the way to Pensacola, for our Fifth meeting, this was seriously discussed. Means were the obstacle. W. S. Hart had taken extended long-hand notes of the previous four meetings and promised to meet Adams and write them up fully. At Pensacola I gave a lecture on insects, illustrated by stereopticon. That clinched the matter. The Proceedings must be published. An informal committee waited on our Secretary of Agriculture, Wombell. The Hart and Adams resumé and the papers read at Pensacola were printed. The leaders were not pleased. It had cramped their style.

Painter steps in. He offers to print all the papers in the "Agriculturist," then lift the columns and assemble them. He offers to do this charging only for the material used and additional time required. A number of more affluent members contributed five and ten dollars each. Presto! The thing worked. The style has been retained, and the same printer. It is the most pleasing and easiest read of any horticultural society proceedings that have come to hand.

The Ethelwold episode is completely forgotten, save by the "ancients." Near the middle of the '90's we were suffering from "over-production." Optimists put the orange crop at five million boxes.

Painter aided and abetted a movement by the orange growers to charter a ship and send a solid carload of oranges to Europe. The finest and most advanced piece of co-operative work done by Floridians. As a trial shipment, the only one, it was a great success.

Fate drew a card; filed it. The Arctic Circle burst open. A blizzard escaped. Cold chills went down the backbone of the North American continent, lost itself in the wilds of Mexico and Cuba. Rumors said that it snowed in Cuba; the flakes melting before reaching the ground. The citrus industry was thrown into confusion.

Painter's untimely and entirely accidental passing robbed the state of a staunch promoter and the Horticultural Society of a profound stimulus. The rest of us had to carry on, but the vacancy still remains. The guiding mind had ceased to function.

Krome, W. J. Neither the history of Florida Horticulture nor the horticulturists of Florida will give him the credit for the determining role he played during one of the most critical periods—the citrus canker fight. The progressive people of Dade County fought the insidious canker to a standstill without either state or Federal funds. The motivating force was collectivism—the inspiring force was Krome.

The physical difficulties and litigations gave Krome a clear insight into what a plant quarantine act must contain and what funds would be necessary for its successful operation. It taught him where to look for support and what obstacles would have to be overcome.

Krome was raised in Illinois, hence a collectivist and did not know it. He was a trained and practised engineer; hence his straight thinking. He did not, like the rest of us, have to unlearn a lot of text-book stuff "that was not so" in horticulture. He was not a lawyer and hence could think and write without "where-ases," "afore-saids" and "before-mentioneds."

He wrote the Plant Board Act and the Legislature approved it. He wrote the Plant Board rules and the Board judged them to be good. The Plant Board law and its rules have stood the test of the Supreme Court. Krome told me that the magnitude of the appropriation so overawed the Legislature that they did not study the Act; passed it as written. Actually it was so logically and scientifically written that it was recognized as a masterpiece.

Do not for a moment assume that I say that Krome did all of this individualistically. He was not an individualist; he did more than his share; and others went to the limits of their ability and opportunity. He brought all of the elements into alignment. He saw more clearly than anyone else the intricate interrelations and foresaw emergencies before they arose. Krome was acting as a private individual with no ulterior motive save the prosperity of the state.

In formulating the law and rules, Judge Price gave whole-heartedly of his time. After the Plant Board Act became a law, Krome, Tenny and Rolfs became the Advisory Committee to the Plant Board until a Plant Commissioner could be employed. The able Wilmon Newell demanded that this committee continue to function, as a condition to his acceptance of the commissionship.

To Krome belongs greater credit than to anyone else. He repeatedly denied this; he would point to someone else who saved the day. But Krome had already seen to it that the man would be there when he was needed.

(See also McQuarrie, under Deciduous Fruits.)

TRUCK GROWING

Truck growing has always been a tolerated stepchild to the Florida Horticultural Society. Our first President, Dudley W. Adams, used the epithet, "Old squash head from the Manatee" in referring to a truck grower from that section. Following the winter of '94-'95, many a citrus grower debased (?) himself by truck growing in order to rehabilitate, but not Dudley W. Adams. He was a citrus grower or nothing. Many a citrus purist through adversity was converted to a program of diversification, most of them have "fallen from grace."

The whole evening might be devoted to romancing on truck growing. How a good lady made so much profit one year on Irish potatoes that she had to sell her farm to pay the income tax the succeeding year. How old Portuguese Joe, a cook, was marooned on a desolate island south of Jensen by an angry sea captain. How he homesteaded, grew snap beans, was offered six thousand dollars for his land and refused. Joe told me that he knew how to grow beans, but did not know how to take care of so large a fortune. Joe was wise. He said: "Nao sell nao." The county attorney, in settling up the estate of $15,000, found a daughter in Portugal, living near penury. If the story were properly polished up, it would make a prize winning romance.

How an agricultural writer in the late '80's proved conclusively that Irish potatoes could not be grown in Florida and especially not at Hastings. Last year Hastings shipped nearly two million bushels.

How, toward the end of the bicycle era, dwellers in two room shacks rose to the opulence of automobile owners and were on the roll to pay income tax.

There is not a county in Florida where climatic conditions are prohibitive of remunerative truck growing. The inhibiting factor is sociological; in this is included transportation and competent labor during rush seasons. Places in which truck growing has been highly developed are not always the best places climatologically, nor always on the most favorable soils. Science has done something to even up these defects, but spraying, fertilizing, draining, irrigation and protection against frost are expensive prices that we have to pay for sociological advantages.

"Truck growing is the poker game of Agriculture," in which transportation interests and fertilizer men are the "stake holders." There were and are some gifted and natural born truck growers. How otherwise can you explain the vagaries of grubbing up a grapefruit grove to clear the space for truck?

Most truck growers are individualists. They cannot act collectively; are easily intimidated by the interests or bought off by promise of immediate gain. They are improvident; they stake all on one year's crop. They are itinerant. I have met the same individual trucking in four different centers. Where they have acted collectively, they have had to be "bludgeoned" into line by sheer desperation. Even in the last decade and a half, the "strong arm" tactics have been more potent than an innate collectivism.

Frank Earle of Palmetto was a born horticulturist. Typhoid cut off his career as a Bermuda onion culturist on the Manatee. He belonged to a family of horticulturists (Parker Earle). He

was splendidly educated. Bold with caution. He was from Illinois, the region where a "community of interests" dominated in agriculture. I expected a large extension of this crop with Earle as the motivating figure. Fate decreed otherwise.

Howard, Kennedy and Lyle rescued Terra Ceia from trucking oblivion. Their cry, "Rescue us, we are sinking," had gone up to the Experiment Station. Director Clute responded. Lyle was so despondent that he offered to sell out his whole interests, lands, tomatoes, eggplants palmetto shacks were the only warehouses and dwellings), for the price of a ticket back to Mississippi, his home. Later that year he had paid off all his debts and had money in the bank. Made it on tomatoes and eggplants. How after Bordeaux mixture had lifted the tomato growers onto Easy Street, it was used on eggplant aphis with discouraging results. Another cry for help; kerosene emulsion did the trick. Later Lyle disgraced (?) truck growing by becoming a banker.

Such are the patches Fate used to design her horticultural "crazy quilt," truck growing. Yet with it all truck crops have aided immensely in the upbuilding and prosperity of the state. Some well directed and well organized truck enterprises occur. These have been due to the efforts of outstanding and exceptional individuals.

### STRAWBERRIES

Up to the late '80's strawberries had been planted in a garden way in nearly all parts of Florida, mostly without success. Stephen Powers, editor of the "Florida Farmer and Fruit Grower," took up the work seriously at Lawtey. Through his instrumentality, the plantings were extended and shipping methods perfected. Lawtey and strawberry growing became synonymous. Powers moved to Jacksonville, Lawtey lost her supremacy. She still grows and ships berries, but other cities in the vicinity surpass her. The great strawberry center at present is in the Plant City region.

Powers was Secretary of the Horticultural Society at the time of his death. He was genial and obliging, but almost painfully reticent.

### DECIDUOUS FRUITS

PEACHES. In the late '90's, peaches and pears vied with the orange for popularity. Delicious peaches have been produced from as far west as Escambia County to as far south as the Everglade country. Last year I ate fine peaches grown by Mr. Alfred Dickinson, at Bonita Springs. F. D. Waite grew fine honey peaches at Palmetto. Kissimmee shipped delicious Peen-toos in the nineties. Orange, Lake and Volusia Counties have produced peaches on a commercial scale. The nurseries of northern and western Florida grew peach nursery stock by the hundreds of thousands. Taber and Godby originated varieties that had special merit. If we had the data, it would probably be found that the total number of peach trees sold in Florida would exceed that of citrus. During the '90's peach nurseries were the more extensive.

The big peach growing region was centered around DeFuniak. The West Florida Horticultural Society did valiant work to stimulate peach growing. Large shipments of Elbertas and Sneeds went forward. C. K. McQuarrie, George Mellish, Plank, and Stubbs took leading parts.

Through propaganda by the railway companies, people planted extensively. When production increased to a stage where the early peaches were no longer sold as a novelty, the cost of transportation and sales commissions exceeded selling prices. In other words, those agencies between them smothered a promising industry.

Peach growing for the early and fancy markets throughout Florida and as far south as the Everglades, merits investigation. The varieties and stock have not been standardized. The varieties must be chosen so as to ripen ahead of the more northern crop.

PEARS. The pear growers were widely scattered from West Florida, centering at DeFuniak Springs, to Central Florida. Archer was one of the largest shipping points. The orchards were rarely more than ten acres in extent. Remnants of orchards planted over forty years ago testify to the hardihood of the Le Conte. Some fruit was produced on the Manatee. Lake County made some shipments. Pear orchards of small size were planted in nearly every community from Central Florida, northward.

As a commercial proposition pear growing found itself between the upper millstone, transportation, and the nether millstone, the pear buyer. Transportation had to be prepaid, so the buyers bought for a price that assured a profit to themselves. No wonder a substantial income to Florida disappeared.

KAKI, JAPANESE PERSIMMONS. This delicious fruit has never attained the popularity it deserved. At the time of its ripening, the northern markets are glutted with home grown fruit. A small quantity can be marketed there, at remunerative prices, to the fancy trade. Its high nutritive value is appreciated by but few. At one time it was recommended that the Lake County crop be used for fattening hogs. The Kaki, which is to me one of the most delicious fruits, is rarely available on the market, even in Gainesville.

A NEW PICTURE. The introduction of trucks and automobiles has profoundly modified the picture. Today Florida alone would absorb all the deciduous fruits she produced in her palmiest days. The trucks effect the distribution that was lacking in the '90's. The fruits ripen when there is a dearth of homegrown fruits. Georgia peaches find a lucrative market in Florida.

The production of deciduous fruits in Florida could be made to supply a large local demand. The fault is ours, not that of the fruit, nor the soil, nor the climate.

### SIX MORTALS AND IMMORTALS

GODBY, T. K. Originator, propagator and distributor of Godby and Waldo peaches.

Our earlier Proceedings occasionally refer to his work. In later years he devoted himself especially to ornamentals. He has an extensive fund of practical knowledge of deciduous fruit growing in Florida. Reticent, almost a recluse.

HEALY, G. P. The Bald Eagle from Volusia. Noted for his want of hirsute adornment. His sudden attacks, sarcasm, wit and oratory carried us over scientific doldrums. He started in as a citrus grower; then went into peach growing; a good man gone wrong, he finally went into politics. He was one of the last of the commercial peach growers.

HENDERSON, F. P. A Florida Cracker with a Yankee temperament. Dabbling into all sorts of horticultural projects. His distributions of *Sphaerostilbe coccophila* by mail had attained to large proportions and was growing. Hundreds of acres of peach orchards in Texas were treated successfully with it. He was the only active merchant in that field for red-headed fungus of the San José scale. He was disturbed because the peach growers were reaping so large a profit and he was getting so small a price for the fungus. The "testimonials" from customers would have filled the heart of an insecticide manufacturer with envy. It is the cheapest and most effective San José scale remedy that we have. In fact, it is naturally so efficient that the name of the scale has nearly disappeared from our vocabulary.

The great obstacle for its more general use lies in the fact that it has few friends among the entomologists, no friends among the large interests of insecticide manufacturers and the spray machinery manufacturers. Some of the "higher-ups" in Entomology feel that the less said about the "fungus enemies of scale insects, the better." Their principal interests lie in the direction of propagating parasitic insects—a most laudable field.

The weak point in applying nature's remedy is that the horticulturist depends on the state and Federal agencies for propaganda. And, believe me, it is exhausting and time consuming. Propaganda often accounts for more than 50% of the price of some insecticides and spraying machinery. If a scientist were to expend that much of his time for propaganda—well, you know what would happen to him.

On account of the possibility of distributing diseases and pests the distribution of natural material is not permitted.

MCQUARRIE, C. K. Secretary of the West Florida Society at the time of our Pensacola meeting. A farmer and fruit grower from DeFuniak Springs. The West Florida man on whom we could always depend for help in the Farmers' Institutes. Later he became county agent for Escambia County. From that he was promoted to State Agent. In this latter capacity he did his really great work. His intimate acquaintance with North Florida agriculture, horticulture and county commission culture. His Scotch geniality; his

rugged honesty; his directness of purpose, brought many a county into alignment. You, my friends, have profited from him more than you realize. He brought to you many an educated man as county agent, who knew or would soon learn to know, local conditions. In place of concentrating agricultural knowledge at the Agricultural College, it was diffused to every county co-operating. His acquaintance with thousands enabled him to mould the sentiments of legislators and county commissioners.

Through the farm and home demonstration work, agricultural education was carried to the point where it was most needed, the country home and homestead. McQuarrie was a staunch believer in collectivism. He had seen the West Florida peach industry fade out because it was "everyone for himself and * * *." From his dour experience in West Florida, he perceived that our weakest point was the lack of agricultural information by the rank and file of the rural people. But for the good work done in the counties, the canker fight would have been lost. The Medfly would still be with us. And what would have happened two years ago to the Experiment Stations and to the Extension work, without a united front?

"There is a divinity that shapes our ends,
Rough hew them how we will."

My dear old C. K.!!! You have journeyed to that distant land from which no visitor returns. How I miss you!!

MELLISH, GEO. He was one of the most active peach growers in DeFuniak Springs, but had to surrender because the transportation charges were greater than "the traffic could bear." He headed our operations for the extermination of the San José scale. In his company, we checked over every peach, plum and apple tree in Walton County and the presence or absence of San José scale was noted. Later he headed the Experiment Station field operations of spraying.

One of the amusing incidents that happened was when we visited the spiritualist to get permission to inspect his orchard. He assented readily enough, after lecturing us on the influence of mind over matter. We had expected to be refused permission. We had left him until the last. He told us that, of course, we would find the scale insects present because that was in our minds. When we revisited him to report that nearly every one of the trees was infested, he said he knew beforehand that we had our minds made up on finding it and of course we saw what was in our minds. He admonished us to go home and forget that we had seen the San José scale in his orchard. That as soon as we had forgotten about his orchard, the malignant spell would disappear. Sure enough, when I revisited it about a year and a half later, I could find no scale. Nor were there any fruit. He regarded the use of fertilizer as another hallucination of the community—he used none and marketed no peaches.

TABER, GEORGE L. A "down Easterner." Brought with him all the amiable and rugged qualities portrayed by novelists. Has written himself indelibly into Florida Horticulture through his nursery catalogs, in the Proceedings of the Horticultural Society and in articles to the horticultural press.

His leaders were peaches and kaki (persimmons); of both much was expected. I met him first in 1892; reticent but genial. He "inspired" Hume to write "Citrus Fruits and Their Culture." "'Nuf said."

PECANS

The pecan is unique in Florida Horticulture. It has never had a boom and so never had to be deflated. Like the rest of us, the pecan grower has had his years of exhilaration and years of depression, but the tree keeps on serving its owner. The old time propagandist advertised it as an absolute resistant to any insect pest or disease. The pecan has fallen from grace. It has attracted some insect pests and acquired some diseases. It can now be catlogued as a domesticated species.

BROWN, ARTHUR, Bagdad, Florida, was a voluminous writer on the taproot hypothesis of fruitfulness. He had a score or more bearing seedlings producing excellent nuts of large size. It was the beginning of the pecan era—late '80's and early '90's. Brown by vigorous publicity had worked up a good trade for seed from named trees, one he called Helen Harcourt. Our friend Taber and other nurserymen were beginning to

put grafted nursery trees on the market. Arthur Brown set up the theory that no pecan tree with a damaged or defective taproot would produce a crop of nuts—hence, as a corollary, no nursery pecan could possibly be remunerative. After the hurricane of 1893 or 1894, I visited my friend Arthur and he very reluctantly permitted me to make photographic exposures of some of the overturned pecan trees. Some of them had no taproot whatsoever. We compromised. He promised to forget about taproots and I promised not to publish the photograph. It was a lucky break for me, as the plates had been over-exposed and were quite useless. The nurserymen never knew why Brown said nothing more about taproots.

Dr. J. B. Curtis, Orange Heights, originated and propagated some excellent varieties of pecans. Among them the Curtis and Hume (Curtis No. 5; see "The Pecan and Its Culture"). He has some seedlings from the Brown trees.

### TABLE GRAPES

The growing of table grapes in Florida has had two major periods. The first opened with the experience of Baron von Leuteschau at Earlton, south of Waldo, in the late '80's. He carried on his experiments with the greenhouse types, growing them out of doors. The Baron, not needing the money, ducked out before the decline in the mid-nineties. In the early nineties extensive plantings were made in Lake and Orange Counties. My first basketful of table grapes, Concords, was purchased at Grand Island in 1893, I think it was. They came from a vineyard said to be forty acres in extent. West Florida also took a hand in the grape game. Then there was a "diminuendo."

The second period was ushered in with the second decade of the present century. The principal propagandists were in the Tampa environs. One finds vineyards located well to the northern part of the state.

The Florida Key grape merits mention. Prof. George Husmann made a trip to Key West about 1904 especially to see a notable vine there. The history of this vine dated back to about a half century, making it easily the oldest table grape vine in the state. It had a numerous progeny planted on the Florida Keys and fruiting as far north as Miami. Under favorable weather conditions these vines ripened three and even four crops in a year. Prof. Husmann identified this Key grape as belonging to the Black Hamburg variety.

At the Subtropical Laboratory, under Prof. Husmann's direction, we planted some hundred or two hundred varieties of European and American varieties. We got some good grapes, but the cost of bagging and spraying made the project commercially unattractive. Nevertheless, two different vineyards of five or more acres were planted out. They succeeded, but other commercial ventures were so much more lucrative that grape growing was given up.

Table grapes have been marketed from Miami to Pensacola, but the vines and grapes have need of so much coddling that other lines of endeavor have been more attractive.

### PINEAPPLES

It appears that the first pineapples were fruited at St. Augustine long before they were thought of as a commercial crop. After transportation facilities arrived, the industry spread down the East Coast, utilizing at first only the hammock lands on the islands east of the Indian River. A Mr. Ingram and John B. Beach had an "extensive" planting of two or three acres, northeast of Melbourne, across the Indian River. That was in the early '90's. Pineapple production spread southward like a conflagration. By 1905 it had reached Elliott's Key and Key Largo. The "Conks," long before, had planted some near their habitations. Perrine (See "Nine Leaders in General") appears to have imported some. Palm Beach boasted of having "the largest pineapple field in the world," two hundred sixty acres, in one unbroken tract. Mr. Mathis controlled the largest portion of it. They called him "the most extensive pineapple grower in the world." The shipments from the East Coast figured in the hundreds of thousands of crates.

Slips and suckers had been brought in by sailboat loads. Abandoned and useless fields on the West Indian Islands and even the coast of Mexico were ransacked for plants. Rickards of Boca Raton got a carload from the Hawaiian Islands.

Spruce pine lands rocketed up in price; some

choice tracts went up to the fantastic price of "$100.00 an acre." Shedded pines brought fancy prices produced heavy crops and lucrative returns. The East Coast pines came onto the market after the citrus crop and before the ripening of northern deciduous fruits. Propaganda exploited the region as the horticultural El Dorado. Even bankers "lost their heads" and invested in "choice lots" that existed only on the charts of the skilled propagandists.

The discovery that spruce pine land was a suitable habitat for pineapples was more by accident than by intent, as told me in the early '90's, by a Capt. Hardy, I believe was his name. It seems that he was in New York with a return ticket to Jacksonville and only $10.00 in addition. A schooner came in with some tropical fruits. He bargained for all of the pineapples his money would buy, twisted out the crowns and carried them back with him to the "Indian River country." There he heeled them in near his shack, which in the homestead days everyone built in the spruce pine lands.

Before he could plant them out on the hammock land east of the river he was taken sick and remained in bed for weeks. When he had recuperated he found that the pineapple plants were growing lustily, and feared that a removal to the river hammock land would prove disastrous. They did so well that all his slips and suckers were planted on spruce pine land.

My hat is off to the pioneer; he faced privations with a smile; hardships with ridicule; and isolation was his diversion.

FATE reaches for a card; it has "Cuba" written on it; she hesitates, but decided to place it in the catalog of nations.

Pineapples from nearly all of the West Indies and even Mexico poured into the market created for the Florida crop. The Florida growers struggled on. Then came the knock-out blow. Pineapples were being shipped from Havana, through Miami to Cincinnati for a little more than one-half the price charged by the Dade County growers when delivered at Miami. The steamships sailing out of Havana wanted freight, so put on an all-water rate to Cincinnati. The Republican Congress treated Democratic Florida to a dose of free trade. This prevented any new capital from flowing into the industry. The more progressive growers put their money into some other enterprise. To account for the decline, the former propagandists hollered "freezes" for an alibi. The once prosperous pineapple industry went into a "diminuendo."

T. V. MOORE (son of T. W. Moore, see Literature) was one of the most astute of the East Coast pineapple growers. In the late '90's he had an extensive plantation at Chetolah (just north of Jensen) and trucking fields east of the Indian River. He had an almost year-round income. His laborers were constantly employed. Between the pineapple crop and marketing of truck there was considerable income from marketing slips. Later he proved his ability further by becoming wealthy as a business man in Miami.

CAPT. JOHN SORRENSEN, Moore's father-in-law, stuck it out to his last in pineapple growing.

C. T. MCCARTY, an extensive pineapple grower, past President of the Horticultural Society, switched over to citrus and went into law.

Orlando produced fine Smooth Cayenne, but commercial enterprises engulfed the fields and citrus culture was the magnet. Pineapple growing was an episode. Punta Gorda and Fort Myers shipped an appreciable crop. At the latter place, Washburn drained and ridged up flat woods to make a pineapple habitat. It failed.

DR. H. J. WEBBER and W. T. SWINGLE originated a large number of varieties by hand pollination. These were fruiting in the middle of our first decade. Some of them were of superior quality. At the time pineapple growers were "sick of their jobs." I doubt if one of these superior varieties remains.

### MANGOES, AVOCADOS, CASHEW

The propagation of tropical fruits other than citrus and pineapples is of relatively recent origin. The principal propagators are alive and "live ones." They are living in the most delightful period of Florida horticulture. The airplane and the automobile are at their services. These marvelous highways are theirs free, for the using. Wonderful tropical gardens have sprung up, that forty years ago even the Gullivers among us dared not predict.

At the beginning of the present century, Geo. B. Cellon was just budding his first nursery of avocados and mangoes. John B. Beach, at Melbourne, in the early '90's, had a hundred per cent. success in budding mangoes. He moved to West Palm Beach and lost the art. He was the only man who made a commercial project of supplying "seed grafted" avocados. Later his commercial interests engaged his whole attention. Horticulture lost an able man.

P. J. WESTER was a day laborer at Palm Beach. His rise, self-education, and work in the Philippines are a monument to his ability. A Scandinavian, he ran true to form. He had fine ability to acquire horticultural information, but lacked in inclination and enthusiasm to disseminate either knowledge or plants. Some of his best "stunts" had to be rediscovered. The late EDWARD SIMMONDS, his successor, was an excellent plant man and a good mixer. Left a decided impression on local horticulture. Always had time to show me a species or a variety that was "'appy" and sympathize with one that was not "'appy."

PROF. GALE, at Mangonia (now engulfed by West Palm Beach), appears to have been the first to fruit the Mulgoba. The tree was received from the U. S. Department of Agriculture. He had planted his mangoes on spruce pine land. The natural dryness of the atmosphere had a notable influence on preventing bloom blight (*Colletotrichum*). Later, wind brakes, the growth of orchards and cover crops conserved the atmospheric humidity, bloom blight flourished; production diminished. GEO. B. CELLON bought hundreds of buds from this Mulgoba tree to top work bearing mango trees in the Dade County section.

REASONER, P. W. Pliny Reasoner, as he was affectionately called by almost every horticulturist, I met during my early days. Although a recent recruit, he had made an enviable record for himself. I never met him, but his spirit radiated through his many colleagues until I felt his personality. His untimely and lamentable death occurred before my advent to the state. As far back as 1889 he was quoted as an authority on foot-rot. (Vol. 2, pp. 32 and 34, Fla. Exp. Sta., 1888.)

REASONER, E. N. His influence on Florida Horticulture will be greatly underrated by the historian. The thousands of species and varieties that have found a permanent abode in the state through his efforts will continue to be an ever increasing monument.

The catalog of the Royal Palm Nurseries has been a standard that many have tried to emulate and few have equalled. His papers published in our Proceedings remain as a permanent attestation of his ability.

I think it was near 1893 that I paid my first visit to his home. It seems to me that his soul expanded with the years. All of us older men who knew him as a nurseryman, as a horticulturist, as the head of a family, as a citizen of Manatee County, feel that we can live a better life for having known him.

The Reasoners are well authenticated in literature, but that gives us no idea of their pleasing and amiable personalities.

HADEN, CAPTAIN. Among the tropical fruit growers, he will be best remembered by the Haden mango, a seedling from the Mulgoba. This was the best one, from aomng a number that he grew to fruiting.

It seems to be quite forgotten that the Captain produced the finest lot of CASHEWS that have been ripened in the state. The fruit was luscious and delicious. George Oliver, the tropical plant propagator, while squatting under a tree, gourmandizing on the ripe cashews and fighting mosquitoes with both hands, remarked: "Rolfs, this is the first time I have ever been in heaven and hell at the same time."

Mrs. Haden has told me that these eight cashew trees were from seed that arrived at the local postoffice, from Brasil. There was a note on the box, requesting the postmaster to hand the seeds to someone interested in horticulture, in case the addressee was not to be found. One of these trees is still alive, although nearly suffocated by native vegetation. This abused remnant, overgrown by oaks, is located beyond the east end of Hardee Avenue, about fifty feet from the old stone fence.

NEELD, BILLY. The caustic, vitriolic Billy. He said little and wrote less. But sometimes when he did, it seemed as if he dipped his pen into concentrated sluphuric acid. In his family life—he was a very meek and subdued husband. I enjoyed his irony and sarcasm. His wit in taking off some of our foibles was excruciating; though I never

heard him laugh, he always had a smile. He told me that he made the money that bought his home place at Pinellas by hunting plume birds.

In the early nineties, he had the finest mangoes that I had seen anywhere till after 1900. One tree was probably a seedling from some grafted tree that had been imported by the U. S. Department of Agriculture during the '80's. It was my first experience, 1893, with the mango bloom blight, *Colletotrichum*. He had sprayed with Bordeaux with excellent results. The best tree was lost two years later.

BUTLER, CYRUS. Memorialized by an avocado; lived fifteen days without nourishment, excepting water, to cure an intestinal trouble. An ex-University student, he lived alone in a house amid avocados and citrus. His splendid work had to give way to "progress." It is now city lots, inside St. Petersburg. His horticultural dream dissipated. He grew oranges as a maintenance crop; sold kumquats to make money; spent it on a hobby, avocados. His citrus grove was unique and profitable. The trees were of round oranges each with a skirt of kumquats.

ROMANCING. The centers of avocado and mango production are in lower Dade, in the Charlotte Harbor region and on the Manatee. A large tree of the Mexican avocado, thirty years old, is growing at Earlton. Fine specimens nearly that old are growing on the Experiment Station grounds at Gainesville. These are from seeds grown in the Captain Haden grove. At Orlando occurs the largest avocado tree I have ever seen. The trunk is seven feet in diameter; the top sixty feet high and fifty foot spread. Probably a West Indian. This tree is hundreds of miles from the centers of production and a thousand miles or more from its native habitat. Why?

### CITRUS

Whoever writes up the anecdotes and romances connected with citrus will fill a large volume. I shall not attempt it. I will limit myself to those incidents that stand out in my memory as having had potent influence on the trend of this great industry. Some of the names I am about to mention already have notable places in our citrus literature. But the reminiscences I wish to record give some side lights that are gleaned only from personal contacts.

At times remote events caused us serious perturbation. The policy of the United States Department of Agriculture has had a direct influence. The Orient sending us the citrus canker caused us annoyance. This paper is concerned more with personal foibles and apparently trivial incidents. Sometimes leading in the right direction and sometimes initiating mischief.

### MEN: ALPHABETICALLY ARRANGED

ADAMS, DUDLEY W. President Adams in one of his annual addresses proved conclusively that his protonym, Adam, was not tempted by the ordinary apple, but by the orange, the apple of the Hesperides.

In a debate Adams was often picturesque. He was a rank specialist. He maintained that Florida horticulturists must specialize as to crops and especially on citrus. He had short patience with the diversified types of horticulture. In one of the debates he used the epithet, "Old squash head from the Manatee."

We young scientists were remembered with wit and sarcasm.

He taught that nature, given a chance, would correct such defects as dieback, scale insects, etc. He tolerated entomologists, but plant pathologists were merely faddists that would be self-eliminating. Some of his teachings were most excellent; they knocked out many an hypothesis. He was a most vehement anti-prunist; a wide spacer for trees. He practiced mulching, citing hammocks as being nature's teaching.

Rigidly individualistic; sociable and kindly spirited. He enjoyed isolation. C. F. A. Bielby was the only man who led an open insurrection against him for the presidency.

BEAN, E. Manufactured and distributed insecticide. He had set up an extensive business for those days. Recommended the use of his insecticide for curing blight. This was developed on the idea that "Angulula" was the cause of blight. Copious injections of Eureka insecticide into the soil were recommended—very profitable to the manufacturer.

Bean was not enamoured with us young fellows. So if he could spike the scientific guns by an-

nouncing a veritable cure for blight, there would be no reason for Swingle's further sojourn in the state. Swingle retorted by showing how lime-sulphur spray could be made for about one per cent. of its market price. Bean exhibited his patent right and warned the citrus growers not to infringe on it. Swingle exhibited a chemistry showing that lime-sulphur solution was discovered before Bean was born.

I wonder! If there is a modicum of truth in the assertion. May not some type of blight be beneficially affected. Blight is relatively less important now than in those days.

Boggs, A. A. Made enough profit from his North Carolina apple orchard to grow grapefruit south of Coconut grove. He was the first to establish a commercial grapefruit grove in that region. It was the pioneer for that region and southward. Horticulture irked him; he escaped into politics, law and a premature demise.

Cunningham, A. S. A student from Bunsen's laboratory; condenmed to convalesce in a tropical climate; and settled at Altoona. Still referred to in the American Journal of Botany (Vol. 22, p. 346, 1935) by Webber. Highly educated and especially in theoretical chemistry. He was chagrinned that the rank and file of our horticulturists failed to appreciate him. He divined what was wrong; learned the scientific names of half a dozen common plants and insects and used them on every occasion. He no longer said "whitefly," but *"Aleurode citri";* no longer said "gopher-apple," but *"Chrysobalannus oblongifolius."* In less than a year's time he was a "great scientist." Moral, Do not hide your light under a bushel. Learn a few scientific names and always use them. Then people will know that you are highly educated.

He was the "pinch-hitter" in establishing the Subtropical Laboratory at Eustis. Without his timely assistance the laboratory mght never have been erected there.

Duncan Brothers, of Keene. A. L. Duncan, of Dunedin, co-tempore, should not be confused with them. They had the unenviable distinction of having been the introducers and distributors of the cottony cushion scale. It was done quite innocently. Fortunately specimens were submitted to the entomologist at the Experiment Station. Vigorous steps were taken at once by Director Clute to subdue it with insecticides. Unfortunately this firm had distributed many packages by mail, principally ornamentals, to widely separated places. Later, introduction of *Cardinallis* controlled the cottony cushion scale.

Gillette, M. E. Gillette, Waite and Brown made their debut in citrus culture at Belleview, Marion County. Their principal activities were in Hillsboro and Manatee Counties, though some of their best formative work, for the industry, was done in Marion County.

Hammond, Benjamin. Thrip juice, once a rather prominent remedy for a multitude of evils. Especially recommended for preventing thrip marks. One of Mr. Hammond's side issues. It was the earliest spray recognized as a sweetener for citrus fruits. Even in the '90's some growers recognized the deleterious effect of this arsenical spray. Some denounced it as ruining their fruit. It went out of fashion during the first decade of the present century.

Hart, W. S. Always genial, altruistic to a fault. He has taken out nineteen patent rights and the citrus growing public benefitted without any compensation to himself. He gave unstintedly of his time and money to the Society. Diffident, modest, retiring. It was always embarrassing to him when his achievements were mentioned in the sessions. He is looking forward with pleasurable anticipation to our Jubilee meeting.

I wonder if there is not someone among the citrus growers who can aid him to put his latest patent, a citrus clipper, on the market. For the want of funds and strength he is unable to do so.

Hollingsworth, G. S. "Thirty-five Years Among the Trees, or the Quintessence of Orange Culture," Enterprise Publishing Co., Arcadia, 31 pages, price, $1.00. (Date wanting.)

"The clipping and pulling of citrus fruit is another point on which, we are sorry to say, nearly everyone is against us just at present." "The writer has all round oranges and grapefruit pulled." "Some of these wise creatures" (who employ clippers) "swallow a pole-cat and gag at a vinegar-gnat." (p. 16). "We will simply say that lemon is the best to bud later on if you will be guided by this book." (p. 8).

Hollingsworth was thoroughly disgusted by being overwhelmed by the clipper men. He went home and published his own "proceedings."

Now comes the surprise. According to reading notices dated April, 1935, Prof. J. R. Winston, Horticulturist, U. S. Department of Agriculture, has discovered "Pulling grapefruit instead of clipping it gives less stem-end rot." (Agricultural News Service, Apr. 5, 1935.)

HUBBARD, HENRY G. A resident of Florida by force of physical circumstances. He had a very beautiful home place at Crescent City. A genial and cheerful companion. In 1885 his 227-page bulletin on "Insects Affecting the Orange" was published by the United States Department of Agriculture, from the Division of Entomology That was in the good old days when the azure of Entomology was reached through describing new species. Prof. Hubbard's Elyssium lay in the field of the Coleoptera.

The "great" entomologist had ascended through that portal. Classifying and listing insects was the great scientific indoor sport. It brought salary and applause. When an insect had been classified and its life-history had been traced, the work was complete. The rest was up to the farmers. Occasionally an addenda might give vague instructions for treatment.

The passage of the Experiment Station Act, 1888, liberated a "flock" of youngsters who viewed Economic Entomology from the standpoint of the husbandman. Hubbard "fell from grace." He discovered how to mix kerosene and water by adding soap; kerosene emulsion. Bureaucracy prevailed; Hubbard returned to the fold. Morphology is an important aid to Economic Entomology, but is not synonymous with it.

ROSE, CAPTAIN, R. E. A most constructive piece of work which Captain Rose put over was the chemical standard for ripeness of citrus. It was he who placed the chessmen on the board, so that McRae, Commissioner of Agriculture, and W. C. Temple of the Citrus Exchange got together at the Gainesville meeting. The two luminaries had been at cross purposes and only a master mind could appreciate the opportunity and see how to move the pieces on the board, to win the game. McRae was made Chairman, which kept him off the floor and very busy keeping order. Temple, a past master at handling such a situation, had the State Chemist and the Experiment Station to aid and abet him. Both of these had shown that the sugar-acid ratio in the juice of citrus fruits was a more reliable test for ripeness than any other. But nobody did anything about it. Temple had provided the salary for a Chemist; The Experiment Station the laboratory to make a long series of sugar and acid determinations. This had convinced him completely. But still there was hesitation. A public meeting was necessary. A. M. Henry, Assistant State Chemist, made public determination of any orange handed him and this proved to be the final clincher.

Florida was the first state to adopt a rational standard for citrus maturity.

We could always count on the Captain for help in the Farmers' Institutes. His papers before our Society were timely and worth-the-while.

SAMPSON, F. G. A strong individualist; that was why he could go into the wilds twenty miles from railroad. before there was a citrus industry, 1874; convert wild trees half a century old into a prolific orange grove. His grove at Boardman remained remunerative to the end of his days. Through all the changing vicissitudes, Sampson was always ahead in the game. He was the one citrus grower who could not be bluffed, browbeaten, domineered over or bribed. When the transportation company abused his fruit in transit or delayed it in delivery, they had to pay the damage, full damages or no settlement. The same with the buyers of his fruit. He demanded only what was just and accepted nothing less. He told the railway attorneys they might as well pay up at once because he would keep after them until it was finally settled and they learned that he was not bluffing. When the railroad proposed to abandon the station at Boardman, he informed them he would charge rent for the right of way, which was given in consideration of a depot at Boardman. He had been astute enough to have the letters recorded in the Marion County court house. The railway station continues to function. He adhered to the good old Quaker adage, "If thou cheatest me once, that is thy fault; if thou cheatest me twice, that is my fault."

Personally most affable and genial. A constant attendant on the Horticultural Society and Citrus

Seminars. An annual and most welcome visitor to the laboratories of the Experiment Station. Sometimes it took a day. sometimes two days. to dig up the information that he needed.

He was most generous in giving out information that had cost him dearly, but so diffident that he could not bring himself to speak before an audience. He wrote very infrequently. He even threatened to remain away from our annual meetings if we persisted in calling upon him to speak.

In addition to his orange grove, he had a remunerative lemon grove at Safety Harbor in Pinellas County. He told me that either one would give him a greater income than he needed. The lemon grove gave better returns and was more attractive, so he sold that. It has been worked over to grapefruit, I believe. He considered a lemon grove the best citrus proposition in Florida, but, as he put it, he would want all his time free to grow lemons.

He was a strong individualist; not a provincialist.

STEVENS, H. B. He was brought to Florida on a stretcher. In the darkest days of our citrus industry (1895), in an informal group between sessions, all that said anything were planning to leave the state. Stevens, robust, genial fellow. spoke up and said that he came to Florida to die and was of the same mind still.

Always companionable and always doing something worth while. He has completed for us four outstanding projects:

1. Dredging muck from Orange Lake to fertilize an extensive grove. Result, the adage. "Hauling muck is a harmless amusement."

2. Exterminating the whitefly after defoliation by cold with DeLand as a unit. Citrus and all other evergreens which might harbor the pest were completely defoliated. Results, negative. Dr. Berger discovered later that the pupal stage of the whitefly can live on dried leaves until new growth of citrus appears.

3. Protecting citrus with half shade, sheds; can be done, but was not profitable in ordinary years.

4. Producing a citrus grove in a piney woods. Last year I saw his sixty-acre grove ranging in age from trees recently set out to twelve years old. All in splendid condition and as remunerative as groves under ordinary conditions. I would not have believed it without seeing it.

STEVEN, J. A., Son of H. B. Stevens. To him belongs the credit for initiating the Citrus Seminar, in 1910 or 1911, in the old dormitory, Thomas Hall. There were no set lectures, simply laboratory demonstrations and explanations. The first call was for 15, our seating capacity; 29 enrolled with an average attendance of twenty-three per session.

The next year we had moved into the new Experiment Station building. The attendance was more than doubled. The good reciprocal effect of these laboratory exercises cannot easily be overestimated. They brought out many of the citrus growers who rarely attended the Horticultural Society meetings. The Experiment Station staff was put on its mettle to provide instruction that would fit in with the knowledge of the citrus growers. Really a one-week laboratory course.

Classes were held from eight in the morning to five in the afternoon with two hours for lunch. In five years the attendance had so increased that even the commodious laboratories of the Experiment Station Building were inadequate. Formal lecturing had to be resorted to. Splendid help came to us from Tallahassee and from Washington.

By 1920 the attendance reached some 250, rivaling the Horticultural Society. It more than justified J. A. Stevens' concept; but had lost its original basis—a meeting of a small group of citricultural scientists. The Seminar ideal.

About 1915, the leaders in the Horticultural Society were fearful that the growth and popularity of the Seminar wuold cripple the Society. The two programs, however, were mutually complementary. The Seminar took up all sorts of problems and fact supported theories that might or might not stand when the grove man brought in his criticisms.

The Seminar is one more of the has-beens; the Florida Horticultural Society keeps on functioning. The practical citrus grower seems to have developed faster than the scientist.

SWINGLE, WALTER TECUMSETH. I first met Swingle returning from the 1892 Horticultural Society at Ormond. He invited me to call at his headquarters at the Magnolia Hotel in Leesburg.

which I did sometime about June or July. He had preceded me to Florida about six months, so naturally I looked up to him as as an old-timer. I asked him what in his opinion was the worst disease of oranges in the state. Instantly he replied, "Non-residence!!"

He was a most delightfully witty companion; very generous in what he did for others. Rules and regulations irked him; he enjoyed circumventing them. He said that his greatest irritation in Germany was the omnipresent "Verbotem."

His encounter with Bean of the Eureka insecticide was so masterly that no one else had the temerity to attack him. He saw more clearly the real interrelations of science and horticulture than anyone I ever talked to. He showed me clearly that our set-up was basically wrong. Instead of studying the orange as a crop, we were giving all our thoughts to the diseases or insects. That we were recommending all sorts of nostrums for insects and diseases without knowing anything about the reaction of the tree. Thrip juice (arsenic of potassium) he considered a rank poison to the tree because of its effect on the citric acid of the fruit.

*Fate* drew out a card; it was marked "Chills"; she filed it under Florida. Swingle and Webber moved out of the state.

WAITE, F. D. Genial, companionable and generous. His principal, a Rhode Islander, I believe. frowned on giving out information. Waite made the grove great, but himself unappreciated. Many of his best horticultural practises remain a closed book. He handled the ordinary diseases as if by magic. Blight was the one thing that was too much for him. He could spot a new case sooner. than anyone else that I have worked with. At one time he had a grove of forty-two transplanted blight affected trees.

He amazed me most by rejuvenating old, decrepid and debilitated groves, converting them into remunerative properties. His honey peaches were a gastronomic treat and a delight to the eye.

His packing house, although recessive in some respects, sent out fruit that topped the market. Always working under pressure. Always ready for emergencies that arose or that might arise.

WARTMAN, E. L. Probably best known through marketing the finest pineapple oranges produced in the state. I have not seen their equal. He attributed this to the benign climate and unequalled soil; maybe so. Who can disprove it? He knew Marion County was the best county and didn't hide this knowledge from anybody. He was just as provincial about the Woman's College and the University.

The greatest work he did for Florida Horticulture was when as a legislator he threw himself whole-heartedly into the passage of the Buckman Bill. He served for repeated quadrenninums on the Board of Control and on the Plant Board. Being a grower and shipper of citrus fruit, his judgment determined the actions of these Boards. (See also: Milt Bryan. under Nine Leaders in General.)

### CONCLUSIONS

1. I have endeavored to give you a close-up of Horticulture forty years ago. You know what it is today. Marvelous progress! I record some names and movements that are all but forgotten. Some of them would otherwise be lost. No attempt has been made to cull literature; that may safely be left to an historian. The address is replete in reminiscences, anecdotes and, I hope, data. It should inspire greater courage and greater fortitude.

2. Movements. leading to great good or to great evil, have their origins in trivial incidents, perceived by commonplace men. Great men comprehend and co-ordinate them for private gain and public weal; selfish men for private gain.

3. Florida is a great state. She might easily have been greater. Her beneficent climate; the productive soil; the nearness to the centers of consumption; all favorable. Too frequently, either for private gain or because of lack of perception, we have followed the wrong trend. For the present, our major project is to adapt ourselves to the gasoline age and the new sociological trend.

### APPENDIX LITERATURE

I. EARLY BOOKS.

1. Treatise and Hand-book of Orange Culture, Moore, Rev. T. W., D. D. Ran through four editions, from 1877 to 1881. There appear to have been revisions of the fourth edition, one bearing

the date of 1892 on the title page. There was probably one later printing since the Doctor told me that he had just completed material for the printer.

In the preface to the first edition, the author says naively: "This book is intended as a manual for all who wish to best succeed with the least expense in the growing of the orange." (P. IX, fourth ed.)

In his conclusions to the fourth edition, he closes by saying: "Finally, to be successful, the fruit grower must watch and work; but not always, for soon the golden harvest may be had for the gathering." (P. 152, 5th ed.)

2. MANVILLE, A. H. Practical Orange Culture Including the Culture of the Orange, Lemon, Lime and other Citrus Fruits as Grown in Florida. Ashmead Bros., Jacksonville, Fla., 1888.

In the preface to his modest 122 page book, we find a statement that should be of great comfort to the Florida Horticultural Society. "Orange culture, like everything else in our busy world, is progressive. What a few years since was a chaos of conflicting opinions and practices has been reduced to something like system." (Pg. 5.) "In dealing with this pest (scale insect), it may be laid down as a rule that healthy vigorous trees are seldom or never seriously attacked." This reminds me of the observation of my first family physician: "A perfectly healthy man never has malaria."

The author then devotes some pages (87-90) to the emulsifying of kerosene with milk.

3. WHITNER, COL. J. N. Gardening in Florida, a Treatise on the Vegetables and Tropical Products of Florida. Professor of Theoretical and Practical Agriculture in the Florida Agricultural College, Lake City. C. W. Da Costa, Jacksonville, Fla., 1885, second edition and apparently the last. He devotes five pages to the orange, discussing Varieties, Fertilizers and Culture.

4. HARCOURT, HELEN. Culture of Citrus Fruits in Florida and How to Raise Them. 1886; 125 pps. Also author of several novels.

5. HART, E. H. Federal Point. In the last edition of "American Fruit Culturist," by John H. Thomas, 1885, with 593 pages, only three are devoted to orange culture. These are by E. H. Hart. This gives us some idea of how North American Horticultural literature regarded orange culture.

6. DOWNING, A. J., in his "Fruit and Fruit Trees of America," 2nd edition, published in 1885, dismissed citrus with three pages.

II. BOOKS WITH BIBLIOGRAPHIC REFERENCE LISTS.

HUME, H. HAROLD, "The Pecan and Its Culture." The American Nut Culture Journal, 1906. 159 pages, 38 illus. Bibliography on pps. 153-155.

HUME, H. HAROLD, "Citrus Fruits and Their Culture. Orange Judd Co., 1915, 3rd ed., 587 pgs., 124 illus. Bibliography on pps. 555-560.

III. CURRENT LITERATURE.

1. Experiment Station Bulletins and Annual Reports, Gainesville.

2. Extension Bulletins, Gainesville.

3. Publications by the State Plant Board, Gainesville.

4. Publications of the State Department of Agriculture, Tallahassee. State publications are free to all citizens of the State of Florida.

5. United States Department of Agriculture, Washington, D. C.

(a). Bulletins from Bureau of Plant Industry.
(b). Bulletins from Bureau of Entomology.
(c). Bulletins from Bureau of Chemistry.
(d). Bulletins from other Bureaus.

Federal publications may be purchased for the cost of printing.

6. Nursery catalogs. A complete file of these would present a vivid picture of facts and fancies. Also the evolution of this potent branch of our horticulture. A complete file is probably non-existent.

7. State Horticultural and Agricultural Periodicals.

Weeklies, monthlies and quarterlies have been established, flourished and faded. Often they were determining factors yet one looks in vain for a complete file. This is the fault of the older generation.

The Librarian of the Experiment Station, Gainesville, will thankfully receive any copies or files over twenty years old, for archiving in their fire proof building.

8. Proceedings of the Florida State Horticultural Society.

Published by the Society, $2.00 per current copy. Complete sets rare. Bayard F. Floyd, Secretary, Davenport, Florida. The most complete record of horticultural progress in Florida.

PROCEEDINGS

OF THE

# Krome Memorial Institute

THIRD ANNUAL MEETING

WOMEN'S CLUB, VERO BEACH

April 10 and 11, 1935

**Vice-President Paul Hoenshel, Presiding**

Mr. Hoenshel: The Third Annual Meeting of the Krome Memorial Institute will come to order. The opening address will be given by Dr. David Fairchild, who, as you know, is Honorary Vice-President of the Institute. We missed him from our meetings last year and are pleased that he can be with us this year.

## NEW EMERGENTS AND HORTICULTURE

**David Fairchild, Coconut Grove**

First of all I think most of us will agree that man is a creature of fashions and habits; that from infancy up the vast majority of mankind finds it is much easier to do the things they have already done many times than to do something new. Examples of this fact we find in card playing and in eating. On the other hand there are other seemingly contradictory instincts at work, such as the instinct for making new combinations. This instinct for making new combinations has actuated the medicine man from savage times down to our own. Inventions and discoveries are due to this instinct.

Then there is the dread of being "pecked" at by others which makes timid ones afraid to do new things, and forces them to do what the crowd does or be thought peculiar—and who can bear to be considered peculiar by his peers, even in these days of individualism.

Pareto, the great sociologist, in his classification of instinct calls attention to the great stabilizing role played by what he calls "the residue of persistence of the aggregate." The instinctive resistance to any change in an established mode of living such as a fashion in food or clothing holds together an "aggregate" in Pareto's sense. Working against this persistence of the aggregate is the instinct for forming combinations which leads to new inventions and new fashions.

It is the existence of the human instinct to preserve these aggregates that has made it possible, and may always make it possible to canalize our agriculture and our industries.

If you will grant that Pareto is right then perhaps I may get you to grant other things as following from his general premise.

Let me say at the start that I am not offering any cure or remedy for the apparent "mess" into which man has drifted or perhaps been pushed by the ceaseless forces of his evolution. Nor do I wish to seem to predict anything for the future; and as for learning from the past how to go ahead, I fail to find any satisfaction in the attempt of most historians to apply the yardstick of the past to the swiftly moving events of the present.

I am aware that there is much to be said for a

standardized agriculture. Perhaps the canalization of man's wants has been a necessary stepping stone in his evolution and has made labor saving machinery, advertising and great organizations self supporting. We can never know if this is true or not.

It is interesting to speculate on the difference it might make in rural England if, for example, instead of everybody's drinking tea at four o'clock in the afternoon in Great Britain, and importing that tea from halfway around the world, there were a great many kinds of drinks for four o'clock, the materials for which, let us say, were grown in the British Isles.

Suppose that instead of almost every girl in the United States desiring a box of chocolates, the chocolate for which is grown by the negroes of West Africa, she preferred candied grapefruit, or raisins, or dates, or a host of other things just as good, would it not make a difference in the horticulture of this country? What I am attempting to point out is that our modern agriculture, canalized as it is, could scarcely have become so canalized without the working of this instinct of man and its exploitation or encouragement by those engaged in catering to it.

The tremendous persistence of aggregates is a thing little suspected by most people. This is evidenced by the great surprise which travelers from one country to another exhibit when they find that the fundamental food habits to which they are accustomed are looked down upon and ridiculed by those in a foreign country accustomed to other fixed habits or customs.

Think of the slave trade of the West Indies, considered by some as the starting point of Great Britain's early control of the sea. It is interesting to speculate whether the whole fabric of slavery with the wars it engendered can be traced back to the sugar bowl— to the spread of a taste for the juice of a sweet, coarse grass called sugarcane that started somewhere in India, nobody knows where. If European man had not had a sweet tooth, that grew sweeter, how could this vast structure have been built, and would we have had the mixed African population increasing and spreading over the whole West Indies and our great Southland? And would Cuba and Hawaii and Java have been flattened out by the over production of one crop?

The smoking habit and its exploitation by great organizations, spending billions in skillful advertising signs which make every little girl think it smart to smoke, has spread over the world since the days when John Rolfe introduced tobacco culture into Virginia in 1612, five years after the landing of the first settlers in Virginia. Yet who can affirm that the habit of smoking is an unmixed blessing to mankind?

Man's sweet tooth, his passion for smoking and his craze for wearing cotton clothes have had a most profound effect on the civilization of the entire United States and the West Indies, and already are there not signs of changes in these aggregates? I need only mention rayon and denicotinized tobacco and the fashion for slenderness as perhaps signs of coming shifts.

I am inclined to think that we have arrived today at a new phase in our agriculture, that in the language of Lloyd Morgan we are witnesses of a new emergent novelty in the structure of our society, that we are seeing merge, and rapidly too, the winged man. It was probably in the Pleiocene that the upright walking creature called man appeared, a totally distinct emergent only distantly related to the anthropoid ape. In the twentieth century, under our very eyes, the winged man emerges—a new creature with a flight so fast that the world has shrunk under his wings to a quarter its former size. With this shrinking may come other vast and unexpected emergents.

Just as this planet, in its early stages, changed its character unbelievably with the emergence of water when the two gases, hydrogen and oxygen, united so I suspect our civilization will be vastly altered by the emergence of flying man and the new civilization that this marvelous conquest of the air is bringing with it.

"Yes," you say, "but how about the fixed instincts of man, instincts that have come down with each generation through millions of years, urges that are as instinctive as love, for example; they will not change." I grant this! But let us not confuse fashions and habits with instinct. The fashions change, the basic instincts remain, but

with the changes of fashion our agriculture changes.

I have growing in my yard a derelict of man's changing taste, a few little plants from the Gold Coast of Africa which, when they fruit, should bear the "Grains of Paradise." These Grains of Paradise are as pungent as pepper, and in the sixteenth century they were in great demand by our forefathers. The doctors recommended them as "good for the stomach" in accordance with the theory of the time that the stomach needed "irritating." The fashion was so fixed by the fashionable hierarchy of Queen Elizabeth's court, she being said to be inordinately fond of them, that the ships of the time dared the rigors of the stormy West African Coast to bring back loads of these Grains of Paradise to the markets of Europe. What has become of the habit of spicing the beer and wine with Grains of Paradise?

Pepper was so prized by the Goths and Vandals that Alaric demanded three thousand pounds of it as a part of the ransom of Rome. In the tenth century the pepperers of England were selected to standardize the weights and measures of the king, and developed the weights we are using in America today.

You have only to turn to pages of any history of cultivated plants to find other evidences of man's shifting taste. The urge for certain sensations may last, but the things that produce those sensations may change.

Are there any more fixed habits than those connected with the desire for the stimulant provided by the alkaloid caffenie? Yet the tea habit, introduced into England in the seventeenth century may not be so fixed as we think, nor the coffee and the cacao habit either. Kipling in his "Night Mail," written many years ago, pictures his air pilot drinking a cup of maté. I was startled when I read Kipling's mention of maté, but now every morning I brew my cup of the Paraguan beverage, which I much prefer to tea, and I hear the drone of the Clipper ships of the air bound southward to the land of the maté tree (Ilex paraguensis).

Travel in foreign lands acquaints the traveler with the vastly different customs of different people. If he is not too set in his food habits he learns to like some of them and takes them home with him. I recall how I brought home from Java the great Rijs Tafel, or curry dish of the Javanese, and how I defend it as an ideal summer dish, better than the heavy foods then in use in Washington both summer and winter.

Multiply, as we are doing now, the number of around-the-world travelers and the number of those who will bring back new recipes and new food tastes will increase in proportion. The mobility of those products that pass over our dinner tables will increase just as the social mobility of society is increasing at an amazing pace. This increase in social mobility is a very real phenomenon, of which many people appear unconscious. It multiplies the distractions of life a hundred fold. It increases the chances for emotional contacts between people tremendously, and it destroys any vestige of that quiet life that characterized the existence of our forefathers. It is not only a horizontal mobility but also a vertical rising and sinking in the social scale, the speed of which would make a Victorian dizzy. Not only is it "here today, there tomorrow," but it becomes "laundress today, patroness of the Arts tomorrow."

"What has all of this to do with horticulture?" some of you may say. Just this; since horticulture is supported by the fashions and fixed habits of people, and since great changes are coming that are likely to change those fashions and habits, horticulture must become more mobile too. All kinds of devices will compete with each other to fix for the masses those particular food and fashion tastes that lend themselves to profitable exploitation. These changes will come as small and ridiculous beginnings. As an example of this let me tell you a story and show you a specimen.

In 1896 I called one morning on Dr. H. N. Ridley, who is still alive, and who was at the time Director of a little Botanic Garden in Singapore. He was enthusiastic about some rubber trees that he had in the garden. "They seed well and I have learned how to tap them, but I can't get the planters to plant the seed. It is a discouraging business" he said. As I expressed my interest he added "Would you like to see the latex of a *Hevea braziliensis* tree? Let's take a mustard tin along to catch the latex." He drove

his penknife into the bark and I pressed the tin against the trunk and saw the white milk fill an inch or so of the can. What beautiful stuff it was! As we walked home I couldn't keep my eyes off it and I fear I turned rather a deaf ear to Dr. Ridley's story of how the few planters then in Malaya couldn't see any future in plantations of the Brazilian rubber trees but wanted him to hunt for gold or tin mines instead. But Dr. Ridley's discovery of the proper way to tap the rubber tree resulted in making rubber-growing profitable, and in a comparatively few years there was a great boom in rubber and millions of acres of jungle were cleared for rubber plantations.

I took my mustard tin of latex to my hotel and watched it harden and turn dark. I kept it and brought it back with me to America and then somehow or other I lost it. Just the other day, as I was telling this story to some school children, Mrs. Fairchild happened to find it and pitched it out the window to me, and here it is, a piece of plantation rubber that was taken years before there were any plantations of rubber trees. I have kept it so long that I fear it has outlived its romantic day, for Charles Stine and his group of chemists have now synthesized a good rubber from beta-chlor-butadine. All my memory of the development of the rubber tire and what has traveled on it is tied up with the observation of a botanist on the flow of the latex of a rubber tree—something that seemed so trivial at the time to the government printer of Malaya that he neglected to publish it.

But perhaps I should not play the part of entertainer here. My purpose in referring to the rubber episode is to point out to you what is a conviction with me, that right here in Florida lie scattered about us other plant materials out of which will surely come all sorts of emergent novelties that will supply the new craving of a new civilization, one that may differ far more from that of today than ours does from the civilization of the Victorian era. I am supported in this faith by the history of the grapefruit, the avocado, the papaya, the Spanish lime, the dasheen, and a growing number of new fruits and vegetables that have had their beginnings here in Florida.

I have emphasized the food side of my thesis. I may be entirely wrong. It may be that the new bird men and women will want more restful homes to come back to after their flight and will wish for more things of natural beauty about them, more flowers and rarer plants in their houses, more and lovelier shrubbery in the dooryards.

Into ornamental plants as into food plants enter the factors of taste fixing. I recall that my friend, John Sear, once told me that he made his first money out of the nursery business by sending the variegated form of *Pandanus Veitchii*, so-called, to New York and the native *Nephrolepis* fern to Boston. The former helped develop the craving for variegated pandans, the latter probably resulted in the production of the Boston fern. I wonder if people will always be fond of these two plants; whether something better will not force its way into their lives! Perhaps organization will come that will make orchids so common that we shall see on billboards illustrations of such lovely forms as *Vanda coerulea*—who can tell? Much stranger things than this have happened.

And so today as I look into the faces of you men and women, fellow members of the Florida Horticultural Society, I am forced to believe that better times will come for you along the lines of the production and cultivation of new plant forms and the forcing of these into the lime light of publicity where they will create new fashions and fixed habits of their own and bring a demand for them that will make possible organization for their supply.

As long as the trade is forced by economic conditions to fix people's tastes on the level of cheaply-grown plants there will be, I fear, little progress. But with the advent of crazes for new ferns, new palms, new creepers, new hedge plants, new bouquet plants, and new house plants, higher levels in horticulture will be reached to correspond with the level of living we dream is coming, and that may come when people are far enough along the line of evolutionary development to make it possible.

There may be a Renaissance awaiting our young people! What it will be cannot be pre-

dicted from the elements we see about us. That it will include plants, a greater appreciation of their beauty and usefulness, I would certainly like to believe. The growth in public support of such ventures as the beautiful gardens all over the country would seem to support my faith. What could be more encouraging than the public attendance this season at the hundreds of flower shows, and at the beautiful gardens like Magnolia in Charleston, Vizcaya in Miami, the Highlands Hammock at Sebring and the lovely McKee Jungle Garden here at Vero?

## AVOCADO VARIETIES IN THE LIGHT OF RECENT EXPERIENCE

**Dr. H. S. Wolfe, Homestead**

Four years ago Mr. L. R. Toy, then a member of the staff of the Sub-Tropical Experiment Station, discussed with you the avocado varieties most desirable for planting. Two years later he addressed you again, and described in masterly manner the characterists of several rather new varieties, with recommendations as to their desirability for planting, based on the evidence then available. This list of varieties differed in several cases from that offered in 1931. It is an indication of the state of flux in which the Florida avocado industry finds itself that I am asked to speak again to you this afternoon on the same general topic and that I have some further changes to make in the recommendations.

Let me be quite clear on one point at the very outset, however. There is no more difficult phase of avocado growing today than the selection of varieties for planting and topworking. What I shall say on this subject does not represent my own opinion, which it has been hard to form unaided, but is the result of consultation with leading growers all over the avocado growing sections of Florida.

One of the factors in avocado selection which is most hard to evaluate is the season of fruiting which should be sought. The unfortunate Trade Agreement ratified with Cuba last summer has temporarily made our summer and fall varieties seem rather unprofitable, but we do not know how long this condition will maintain. If we had certain knowledge that there would be no curtailment of Cuban competition for the next ten years, then we could proceed with some confidence to the choosing of varieties which mature after the Cuban season is ended. If, however, the Cuban invasion is diminished appreciably in the next few years, either through the revision of the Trade Agreement with some slight consideration for home industry or through action on the part of Cuban shippers, then our West Indian varieties will be very profitable. In this uncertain state of knowledge, it is unsafe to offer recommendations except with an eye to all possible contingencies.

The extraordinary cold weather of the past winter has caused some changes in our estimate of certain varieties. The variety whose cold resistance was most outstanding was Taylor. Fairly close to it, but definitely less hardy, were Lula and Itzamna. Still fairly hardy were Dunedin and the various Booth seedlings. Waldin, Wagner, Collinson and Linda were hurt to a large extent, but were noticeably more hardy than most West Indian varieties. Very tender to cold were Trapp, Pollock, Winslowson, Simmonds, Fuchsia, Schmidt and Peterson. All of these varieties were observed where a temperature of 26° F. had been in force of several hours. The Mexican-West Indian seedlings originated by Mr. Sexton of Vero Beach have proven less hardy than it was hoped they would be. Their ranking was below Lula. Another variety which we had hopes would prove especially suited to culture in the northern range of avocado planting was the Nehrling. I am indebted to the kindness of Mr. T. Ralph Robinson for information that in Orlando this variety proved much less hardy than Taylor under the

same conditions. At Homestead the same observation was made by the writer.

When a survey of growers on the lower East Coast was made four years ago, the Collinson variety was found to be favored by the majority of them as the first choice for planting. A similar survey today shows that Taylor is now the leading variety in the growers 'estimation, and that Collinson has sunk to the low place formerly occupied by Taylor. Four years ago the order of ranking of some of the standard varieties was: Collinson, Lula, Waldin, Trapp, Pollock, Taylor, Schmidt. Today the ranking of a slightly longer list of standard varieties is: Taylor, Wagner, Waldin, Lula, Trapp, Peterson, Fuchsia, Pollock, Winslowson, Schmidt, Collinson. Taylor is a variety of good size and appearance of fruit, maturing at a desirable season, and of very fair bearing habit. Wagner has fruit resembling Taylor, although it is more subject to black spot, and slightly later in season, with as good or better bearing quality. Waldin is an old and reliable variety, which tends to overbear one year and rest the next. A prolific variety in its bearing years, the fruit is often too small and sunburned because the drain on the tree has defoliated it somewhat. Many growers are favoring a comparatively new variety, Peterson, for the same mid-season period formerly dominated by Waldin. It is apparently a good bearer and a better looking fruit than Waldin. However, Waldin still is very well considered by most.

Lula continues to hold a high place in the list of varieties. Its unusually prolific habit compensates for its equally unusual susceptibility to scab. The fruit is not so attractive as Taylor, which has the same season, and is larger also, whereas the market demand is mostly for small fruit. The flavor of Lula does not appeal to many. Trapp is the old reliable of the West Indian varieties. Only Cuban competition holds its planting down. Fuchsia was hailed as the needed extra-early variety, to catch the June market, and was extensively planted for a few seasons. A number of unsatisfactory features have appeared with further marketing of it. The evidence seems to show that this variety does not ripen very satisfactorily when shipped in June, and does not carry at all well when shipped in August, at which time the fruit has best quality. Until we find a variety which is really good in June, however, Fuchsia will continue to be our early variety..

Pollock has been very generally and widely condemned for its poor bearing habit and the large size of the fruit. Its really fine quality and its comparatively early season have prevented more topworking of it to more prolific varieties. There is no really good summer variety to replace it. The Simmonds has not attained much favor, in spite of slightly better bearing habit than Pollock. Winslowson is another variety very generally disliked for the large size and poor shipping habit of the fruit, although it bears heavily as a rule. Its injury by the cold of last winter has encouraged its topworking to better varieties. Schmidt is a very late maturing variety, but is large fruited and a very shy bearer in the experience of most growers. A few have found it to bear well, but most have not. The tree is weak, unless it is worked on a large stump, and the cold injured the variety to an unexpected degree. A variety of similarly very late season and much better size of fruit, bearing habit, cold resistance, and tree vigor is Itzamna. Linda is a variety maturing in mid-winter and of superlative quality of fruit. Its fruit is too large, however, and its purple color is unattractive, so that it is not considered desirable for further planting. Its tenderness to cold was surprising also. Collinson has lost its former place of esteem because of its large size and its rather poor bearing habit. A large part of this low yielding characteristic may be due to the fact that Collinson has often been planted in solid blocks or interplanted only with varieties of its own class. Being totally devoid of pollen, it cannot pollinate itself even in times of very irregular flower behavior. However, Taylor matures at the same season and has better size of fruit, without the lack of pollen.

Several of the Booth seedlings, known only by number, have been planted on a fairly large scale by some growers. Notably this has been true of Nos. 3, 7 and 8. Their chief virtue was the prolific habit of bearing, but under conditions of more extended planting this habit has been less marked. Growers are making haste slowly in the matter

of topworking to these varieties ,and are working to Taylor, Wagner, and Lula instead. Nirody has not been found desirable on further trial, and the highly colored Collinred B has not fulfilled its early promise of merit. The Sexton seedlings have been found to mature in October at Homestead, and their lack of more than ordinary resistance to cold makes them of questionable merit for planting in the central part of the state, where it was hoped they would find a definite place. The tenderness to cold of the Nehrling makes it similarly unsuited for extending avocado culture northward.

All of the above new varieties seemed promising two years ago, but no longer do so. For this reason I am hesitant to recommend any new varieties for trial, although there are still a few which may prove very meritorius. Sooner or later we shall have better varieties than now, but some one must raise and test them as seedlings before we can have them. Every grower interested in the future of the industry should grow a few seedlings for trial. Taylor, Lula, Waldin, Fuchsia, Peterson, Trapp—all of these were Florida seedlings. Only Wagner and Itzamna of the varieties now favored were introduced as varieties.

In closing this discussion I wish to say a few words about the West Coast, although my acquaintance with it warrants only a few. The previous statements have been based on East Coast conditions. On the West Coast the Lula, Itzamna and Dunedin varieties have shown both cold resistance and good bearing habit. Linda has also done very well, but is less hardy and has fruit too large for most markets out of Florida. A Mexican variety originated by John Beach many years ago has been propagated by Mr. Mose Goering of Anona, and has shown itself exceptionally vigorous, hardy and prolific. While it is reported to have proven unsatisfactory on the East Coast, it seems very promising for the West. It is believed that Taylor will also prove valuable there, although to date no plantings of it have been found.

## THE COMPOSITION OF NUMEROUS TROPICAL AND SUB-TROPICAL FRUITS

**A. L. Stahl, Associate Horticulturist**
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The increasing demand for a greater variety in fruits throughout the year and the realization of the value of fruits in the daily diet are proof that the fruits grown in the tropics and sub-tropics will be more and more in demand by the people of the other sections of the United States to supplement their own fruits. There are more than six hundred edible fruits found in the tropics and sub-tropics and of these less than fifty are in general cultivation with not more than twenty being sold commercially. Of these twenty, only a very few are known to the entire population of the country. There is opportunity, therefore, for an increase in the number of kinds of fruits that may be popularized in all of the markets of the United States. With the present-day transportation and refrigeration facilities, it is now possible to ship most tropical fruits long distances. The appearance of more and more Florida fruits in ever increasing amounts has already taken place in northern markets as well as our own. By reason of the nearness to large centers of population, Florida is well fitted to introduce and popularize the tropical and sub-tropical fruits which she herself finds are palatable and profitable.

Wide competition in the production of many of the tropical fruits does not have to be met, owing to the restricted area adapted to their culture, and the returns per unit for these fruits should be greater than for the abundant, com-

monly-grown varieties of more temperate regions. Some of the fruits are not desirable for consumption in the fresh state, but many of the tropical or sub-tropical fruits can be marketed wholly or in part as manufactured products in forms such as jellies, marmalades, etc., which partially removes the uncertainty connected with the marketing of perishable products such as most of the tropical fruits. There is already a wide market for this type of product.

The general fruit-consuming public is ignorant of the properties, composition and qualities of most of the fruits of the tropics. The banana and pineapple of the tropics, and the citrus fruits of the sub-tropics, are now the best-known and are considered almost indispensable in the public diet, even though fruits of the temperate zone are available. The avocado and mango are gaining in favor, as is demonstrated by the increase in consumption of these fruits. Several others such as the papaya, Cherimoya, litchi, sapote, guava and Eugenia are well known and highly prized in various parts of the tropical world but are scarcely known in the United States except in those areas where they are grown.

The analyses on which this report is based were made to gain information upon the chemical composition of the tropical and sub-tropical fruits which have borne fruit in Florida and show promise of having commercial value. The Agricultural Experiment Station receives frequent requests for information regarding the composition of ripe Florida fruits of various kinds and varieties and the changes in composition which take place during ripening. Almost every grower and consumer has a desire to know more about the nature of new fruits, their nutritive value and possible physiological effects.

A number of the fruits studied by the Station have been previously analyzed elsewhere but very few of these analyses are based on Florida specimens. Moreover, these analyses were made in various parts of the world, in many cases, from fruits which had been shipped long distances in cold storage. All of the analyses reported here were made by the writer according to one uniform method (Methods of the Association of Official Agricultural Chemists). The fruits were analyzed as soon after picking as possible, only mature fresh, whole fruit being used. The results, therefore, reliably represent the relative percentages of various constituents in an unusually large list of fruits from Florida.

Oranges, grapefruit, avocados and strawberries, all major fruit crops of Florida, are not included in the fruits herein discussed, as separate bulletins dealing with their composition are now available. Blueberries, blackberries, grapes, pears and Japanese persimmons are not included, as they are not strictly tropical or sub-tropical in nature.

### MANGOES

The proportions of most of the constituents of the mango, especially acid, oil, ash and protein, are low in the ripe fruit. The moisture content is relatively low for fresh fruit, giving a high amount of total solids in the fresh fruit. The acidity varies and is about 0.5% for most varieties. The sugar content is very high, the total sugars varying from 8 to 14 per cent. in the fresh fruit. In all varieties tested the sucrose is the principal sugar, or most of the sugar is in the hydrolyzable form.

Qualitative tests showed the presence of considerable amounts of tannin, but no starch was found. A considerable amount of free malic and tartaric acids was found, with just a trace of free citric acid.

A comparison of the chemical composition of the Winesap apple with that of our own Haden mango gives some startling results. It was found that the apple contains 14.96% solids, whereas the mango contains 17.2%. In regard to sugar (total) the apple contains about 7.5% whereas the mango has 14%. As regards protein, the apple has about .22% and the mango .66%. The total acidity of the apple is 1.04%, whereas in the mango it is only .31%. The ash content of the apple is .3%, while that of the mango is .5%, or nearly another time as much.

In making these comparisons, we have purposely taken a popular variety of both fruits, and it may safely be said that, in regard to chemical composition, the balance is on the side of the mango.

### ACID CITRUS FRUITS

Of the acid citrus fruits grown in the state, the only ones to reach commercial importance in the last few years are the limes. However, there has been an enormous amount of interest in all of the Florida limes and lemons in the last few years. The Experiment Station has had a large number of requests for information as to the composition of the limes and lemons now growing commercially and of many varieties which are now being tried out. We have analyzed large numbers of this fruit sent in by interested growers and have to date complete analyses on the following acid citrus fruits: Lakeland Limequat; Eustis Limequat; Calamondin; Tahiti, Key, Jamaica, Rangpur and Woglum limes; and Villa Franca, Eureka, Genoa, Meyer and Kennedy lemons.

Comparing the Florida limes and lemons with the imported lemons from Italy, we find that many of our acid fruits compare well in all characteristics except sugar. The Italian lemons are higher in sugar, having around 2%. At the same time, this lemon has a high acid content of 7%. The Sperryola lemon surpasses the commercial Italian lemon in sugar but does not have as high an acid content. Most of our limes and lemons have a higher percentage of juice than those grown in the drier regions of the United States and are equal or superior to them in acid and sugar content.

### OTHER FLORIDA FRUITS

The list of fruits dealt with is intended to include those miscellaneous species which, by actual trial, have shown their adaptability to the soils and climatic conditions of Florida, but most of which are not yet grown in quantity. A complete analysis was made of the following fruits: Sapodilla, Mamey sapote, Cherimoya, sugar-apple, soursop, carambola, papaya, natal plum, white sapote, loquat, rose-apple, Java plum, Surinam cherry, Feijoa, fig, Governor's plum, mangosteen, pitaya, litchi, mammee apple, guava, pomegranate, tamarind, Barbados gooseberry, jujube and watermelon (See Table III). A large number of these were sent in by interested growers and the remainder obtained through the co-operation of Dr. H. S. Wolfe and Mr. W. M. Fifield of the Sub-Tropical Experiment Station at Homestead.

Proximate physical characteristics of fruits, including total weight, specific gravity, skin, seed and edible pulp, and proximate chemical characteristics of fruits, including moisture, acid, oil or fat, protein, ash and sugar, furnish a convenient basis for judging their relative commercial and food values. It should be pointed out here that fruits contain many other constituents not determined in these analyses. Among these are such substances as glucosides, pectins, enzymes, organic acids, vitamins and traces of rare elements.

It is evident from the table that the water content of most of the Florida fruits is high in comparison with the total amount of solids. It varies from 30% in the Tamarind to 94% in the carambola, but the majority of fruits have a water content of around 80%, which, when compared to fruits grown in the temperate climates, shows a higher amount of total solids in the majority of tropical fruits.

The acid content of the fruits varies rather widely from .12% in the fig to 8% in the tamarind, which is higher than that of most acid citrus fruits. On the whole the tropical and sub-tropical fruits outside the citrus groups tend to have a lower acid content than fruits grown in temperate climates. The acidity of most fruits is due to the presence of several organic acids but each fruit usually has a characteristic, predominant acid, such as citric, malic, tartaric or some other similar acid.

The oil or fat content of most fruits is very small. None of the numerous analyses presented here show nearly as high an oil content as do the two fruit exceptions, avocado and olive, which show from 3 to 12 per cent. as compared to less than 1 per cent. in most other tropical and sub-tropical fruits.

The protein content is low, being less than 1% in most of our fruits, but, in spite of this fact, it compares well with that of fruits grown in the more temperate climates.

The ash content of the tropical fruits is relatively small when compared to the other constit-

TABLE I

COMPOSITION OF MATURE FLORIDA MANGOES (1933)*

| Group Variety | Source | Weight (gms.) | Specific Gravity | % Seed | % Skin | % Edible Pulp | % Moisture | % Acid (citric) | % Oil | % Protein | Per Cent. Sugars: Free Reducing | Per Cent. Sugars: Hydrolyzable | Per Cent. Sugars: Total | % Ash |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Mulgoba* | | | | | | | | | | | | | | |
| Mulgoba | Oneco | 320.4 | 1.052 | 8.6 | 91.4 | | 81.5 | 0.53 | 0.58 | 0.50 | 2.1 | 8.9 | 11.0 | 0.38 |
| Haden | Homestead | 457.0 | 1.053 | 6.8 | 93.2 | | 85.3 | 0.31 | 0.62 | 0.66 | 2.1 | 8.3 | 10.4 | 0.49 |
| Haden | Palma Sola | 300.0 | 1.065 | 10.3 | 9.3 | 80.4 | 79.6 | 0.24 | 0.54 | 0.39 | 3.6 | 7.6 | 11.2 | 0.26 |
| Singapore | Oneco | 497.1 | 1.037 | 12.5 | 10.8 | 76.7 | 85.6 | 0.25 | 0.42 | 0.50 | 2.2 | 5.9 | 8.1 | 0.30 |
| *Alphonse* | | | | | | | | | | | | | | |
| Bennett's Alphonse | Oneco | 256.2 | 1.065 | 9.5 | 91.5 | | 82.6 | 0.55 | 0.58 | 0.52 | 2.5 | 9.4 | 11.9 | 0.53 |
| Amini | Bokeelia | 167.0 | 1.057 | 15.1 | 84.9 | | 83.9 | 0.25 | 0.60 | 0.37 | 1.5 | 10.6 | 12.1 | 0.51 |
| Pahiri | Bokeelia | 298.1 | 1.061 | 11.1 | 88.9 | | 82.3 | 0.23 | 0.54 | 0.33 | 2.4 | 9.6 | 12.0 | 0.40 |
| Rajpury | Oneco | 419.5 | 1.041 | 9.1 | 10.9 | 80.0 | 81.4 | 0.47 | 0.50 | 0.57 | 4.0 | 7.5 | 11.5 | 1.16 |
| Bennett | Ft. Myers | 290.8 | 1.062 | 11.2 | 11.4 | 77.4 | 81.7 | 0.21 | 0.34 | 0.43 | 2.5 | 11.2 | 13.7 | 0.65 |
| *Sandersha* | | | | | | | | | | | | | | |
| Sandersha | Homestead | 540.0 | 0.999 | 8.2 | 12.1 | 79.7 | 82.5 | 0.53 | 0.64 | 0.63 | 2.7 | 4.1 | 6.8 | 0.33 |
| Brooks | Homestead | 534.4 | 1.053 | 8.3 | 16.3 | 75.4 | 79.1 | 0.50 | 0.92 | 0.67 | 3.4 | 8.0 | 11.4 | 0.47 |
| Fajiri Long | Palma Sola | 244.2 | 1.060 | 7.6 | 13.9 | 78.6 | 81.2 | 0.57 | 0.40 | 0.52 | 3.3 | 8.9 | 12.2 | 0.38 |
| *Cambodiana* | | | | | | | | | | | | | | |
| Cambodiana | Bokeelia | 294.5 | 1.055 | 10.5 | 89.5 | | 79.3 | 0.61 | 0.78 | 0.55 | 2.6 | 11.7 | 14.3 | 0.38 |
| Cambodiana | Oneco | 302.4 | 1.054 | 10.4 | 89.6 | | 81.9 | 0.71 | 0.68 | 0.86 | 2.2 | 11.2 | 13.4 | 0.42 |
| Caraboa | Bokeelia | 384.0 | 0.973 | 11.9 | 16.5 | 71.6 | 84.8 | 0.65 | 0.77 | 0.49 | 4.4 | 4.6 | 8.9 | 0.36 |
| Cecil | Oneco | 196.8 | 1.062 | 11.9 | 88.1 | | 79.4 | 0.13 | 0.62 | 0.54 | 3.0 | 10.9 | 13.9 | 0.46 |
| Number 11 | Oneco | 158.7 | 1.038 | 17.9 | 13.0 | 69.1 | 81.3 | 0.29 | 0.48 | 0.46 | 5.1 | 5.7 | 10.8 | 0.53 |
| Itamerica | Oneco | 132.9 | 1.063 | 13.9 | 14.2 | 71.9 | 80.0 | 0.43 | 0.62 | 0.37 | 1.9 | 11.1 | 13.0 | 0.49 |
| Peters | Oneco | 237.9 | 1.063 | 10.0 | 90.0 | | 85.6 | 0.25 | 0.71 | 0.45 | 2.4 | 8.6 | 11.0 | 0.58 |
| Pico | Oneco | 287.5 | 1.038 | 6.8 | 93.2 | | 82.5 | 0.50 | 0.65 | 0.42 | 3.6 | 8.4 | 12.0 | 0.50 |
| Langra | Oneco | 359.5 | 1.063 | 8.4 | 91.6 | | 79.3 | 0.51 | 0.70 | 0.41 | 2.3 | 7.9 | 10.2 | 0.63 |

*Analyzed August, 1933 (Average of 6 fruit each)

## TABLE II

PHYSICAL AND CHEMICAL CHARACTERISTICS OF FLORIDA LIMES, LEMONS AND CITRON*

| Varietey and Type | Source | Total weight of fruit (gms.) | Sp. Gr. of fruit | Seed | | % Peel | % Pulp | Vol. of Juice (cc.) | % Juice | Avg. Rind Thickness (cm) | Size of fruit (cms.) | Number of Segments | Sp. Gr. of juice | % Acid | pH | Per Cent. Sugar | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | No. | % | | | | | | | | | | | Free Reducing | Hydrolyzable | Total |
| Limequat (Lakeland) | Lake Alfred | 19.3 | 1.022 | 5-9 | 3.6 | 15.2 | 81.2 | 96 | 49.8 | .09 | 3.1 x 3.4 | 8 | 1.037 | 5.3 | 2.4 | 0.86 | 0.14 | 1.00 |
| Limequat (Eustis | Lake Alfred | 26.9 | 1.003 | 7-14 | 5.2 | 17.0 | 77.8 | 96 | 47.6 | .10 | 3.9 x 4.0 | 8 | 1.035 | 6.1 | 2.5 | 0.90 | 0.31 | 1.21 |
| Tahiti Lime | Lake Alfred | 111.2 | 0.994 | 0-2 | 0.2 | 16.1 | 83.7 | 70 | 62.6 | .16 | 5.6 x 6.7 | 10 | 1.035 | 6.1 | 2.3 | 0.81 | 0.06 | 0.87 |
| Tahiti Lime | Homestead | 89.2 | 1.012 | 0-0 | 0.0 | 22.6 | 77.4 | 52 | 58.2 | .17 | 5.2 x 6.1 | 10 | 1.039 | 6.2 | 2.4 | 1.49 | 0.25 | 1.74 |
| Key Lime | Florida Keys | 31.2 | 1.035 | 3-9 | 1.5 | 15.2 | 83.3 | 20 | 58.1 | .09 | 3.7 x 3.8 | 9 | 1.032 | 8.0 | 2.4 | 0.37 | 0.07 | 0.44 |
| Villa Franca L. | Lake Alfred | 230.0 | 0.944 | 7-22 | 1.0 | 33.5 | 65.5 | 85 | 37.1 | .52 | 7.2 x 9.3 | 10 | 1.035 | 6.3 | 2.4 | 0.48 | 0.03 | 0.50 |
| Genoa Lemon | Lake Alfred | 137.5 | 0.988 | 10-26 | 1.5 | 28.0 | 70.5 | 107 | 39.0 | .36 | 5.9 x 8.1 | 9 | 1.033 | 5.3 | 2.1 | 0.83 | 0.10 | 0.93 |
| Meyer Lemon | Lake Alfred | 143.3 | 0.978 | 13-26 | 1.5 | 18.0 | 80.5 | 149 | 51.5 | .21 | 6.2 x 7.2 | 10 | 1.035 | 4.7 | 2.5 | 1.66 | 0.25 | 1.91 |
| Kennedy Lemon | Lake Alfred | 131.4 | 0.984 | 7-33 | 1.9 | 33.8 | 64.3 | 83 | 31.8 | .45 | 6.0 x 7.7 | 9 | 1.035 | 5.5 | 2.5 | 0.86 | 0.14 | 1.00 |
| Jamaica Lime | Winter Haven | 73.9 | 1.006 | 2-16 | 1.5 | 17.2 | 81.3 | 73 | 49.9 | .16 | 5.0 x 5.4 | 8 | 1.038 | 6.0 | 2.4 | 0.97 | 0.17 | 1.14 |
| Sperryola Lemon | Winter Haven | 58.7 | 0.973 | 12-24 | 4.3 | 21.8 | 73.9 | 26 | 43.2 | .18 | 4.5 x 5.1 | 10 | 1.037 | 4.0 | 3.2 | 2.56 | 0.63 | 3.19 |
| Rangpur Lime | Homestead | 48.8 | 1.012 | 8-10 | 2.5 | 14.8 | 82.7 | -- | 53.0 | .11 | 4.3 x 4.6 | 9 | 1.040 | 6.7 | 2.6 | 0.57 | 0.26 | 0.83 |
| Woglum Lime | Coconut Grove | 61.6 | 0.9112 | 20-25 | 4.5 | 32.3 | 63.2 | 23 | --- | .32 | 4.7 x 6.0 | 9 | 1.036 | 5.9 | 3.2 | --- | --- | --- |
| Eureka Lemon | Homestead | 222.4 | 1.0032 | 7-10 | 2.1 | 56.5 | 41.4 | 27 | --- | .60 | 7.2 x 9.2 | 10 | 1.035 | 5.6 | 2.4 | 0.90 | 0.20 | 1.10 |
| Calomondin | Homestead | 38.0 | 0.952 | 3-8 | 1.6 | 30.2 | 46.2 | -- | --- | -- | ------- | 9 | 1.033 | 4.0 | -- | 2.51 | 0.86 | 3.37 |
| Lemon Citron† | Homestead | 448.4 | 0.959 | --- | 1.6 | 75.3 | 23.1 | -- | --- | 3.28 | 12 x 17 | 11 | ---- | 0.2 | -- | 5.03 | 0.20 | 5.23 |

*All figures are averages of 10 fruits each (analyzed 1931-33)

†Sugar and acid analyses made on rind.

## TABLE III

PHYSICAL AND CHEMICAL CHARACTERISTICS—TROPICAL AND SUB-TROPICAL FRUITS OF FLORIDA*

| Common Name<br>Botanical Name<br>Variety | Source | Max.<br>Min.<br>Avg. | No. Analyses (Avgd.) | Total Weight (gms.)‡ | Specific Gravity | % Seed | % Skin | % Edible Pulp | % Moisture | % Acid (citric) | % Oil | % Protein | % Ash | % Sugars | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | Free Reducing | Hydrolyzable | Total |
| Sapodilla | Homestead | max. | 9 | 336.2 | 1.046 | 4.6 | 11.7 | 89.5 | 80.1 | 0.72 | 1.65 | 0.38 | 0.52 | 5.60 | 2.56 | 8.16 |
| (*Achras sapota*) | | min. | | 131.6 | 1.033 | 1.9 | 7.7 | 83.7 | 73.6 | 0.60 | 0.45 | 0.21 | 0.26 | 5.01 | 2.07 | 7.64 |
| | | avg. | | 257.7 | 1.038 | 3.1 | 9.7 | 87.2 | 75.9 | 0.66 | 1.00 | 0.32 | 0.40 | 5.37 | 2.37 | 7.74 |
| Sapota Mamey | Homestead | max. | 14 | 748.1 | 1.077 | 5.8 | 18.2 | 79.4 | 71.0 | 0.63 | 0.75 | 0.22 | 2.05 | 4.20 | 12.92 | 19.78 |
| (*Achras sapota*) | | min. | | 692.5 | 1.073 | 4.7 | 17.0 | 68.1 | 62.6 | 0.40 | 0.35 | 0.11 | 1.50 | 3.31 | 9.41 | 14.02 |
| | | avg. | | 730.0 | 1.074 | 5.2 | 17.5 | 77.3 | 66.7 | 0.58 | 0.65 | 0.13 | 1.88 | 3.67 | 11.76 | 15.43 |
| Cherimoya | Key Largo | avg. | 1 | 448.0 | 1.024 | 19.1 | 22.6 | 58.3 | 71.1 | 0.41 | 0.72 | 0.94 | 1.10 | 8.60 | 1.04 | 9.64 |
| (*Annona cherimola*) | | | | | | | | | | | | | | | | |
| Sugar-apple | Homestead | max. | 5 | 265.3 | 1.045 | 40.0 | 39.8 | 36.9 | 74.2 | 0.65 | 0.92 | 1.88 | 1.09 | 13.59 | 4.10 | 16.60 |
| (*Annona squamosa*) | | min. | | 210.0 | 1.020 | 31.6 | 23.1 | 28.6 | 69.9 | 0.26 | 0.48 | 1.15 | 0.81 | 11.20 | 1.16 | 12.40 |
| | | avg. | | 250.5 | 1.036 | 35.8 | 33.3 | 30.9 | 72.0 | 0.55 | 0.65 | 1.60 | 0.98 | 12.16 | 2.42 | 14.58 |
| Soursop | Homestead | max. | 5 | 341.6 | 1.048 | 20.2 | 19.6 | 78.5 | 82.6 | 1.74 | 0.56 | 1.28 | 0.84 | 13.40 | 1.90 | 14.02 |
| (*Annona muricata*) | | min. | | 298.5 | 1.026 | 10.9 | 14.2 | 59.1 | 76.2 | 0.92 | 0.48 | 0.90 | 0.41 | 9.30 | 1.15 | 11.20 |
| | | avg. | | 330.2 | 1.042 | 13.6 | 16.4 | 70.0 | 80.4 | 1.56 | 0.51 | 1.20 | 0.56 | 12.40 | 1.25 | 13.65 |
| Carambola | Homestead | max. | 6 | 73.5 | 0.975 | 1.9 | 19.5 | 84.5 | 94.1 | 0.82 | 0.84 | 0.71 | 0.42 | 4.19 | 0.08 | 4.24 |
| (*Averrhoa carambola*) | | min. | | 68.2 | 0.958 | 1.6 | 16.9 | 78.6 | 92.6 | 0.64 | 0.72 | 0.30 | 0.21 | 3.40 | 0.00 | 3.40 |
| | | avg. | | 70.3 | 0.962 | 1.8 | 17.5 | 80.7 | 93.2 | 0.78 | 0.78 | 0.42 | 0.30 | 4.00 | 0.01 | 4.01 |
| Papaya | Homestead | max. | 5 | 3580.3 | 0.765 | 43.1 | 13.4 | 53.6 | 91.6 | 0.20 | 0.47 | 0.30 | 0.50 | 5.68 | 0.60 | 6.28 |
| (*Carica papaya*) | | min. | | 2246.5 | 0.710 | 39.3 | 9.8 | 42.4 | 89.9 | 0.08 | 0.43 | 0.21 | 0.25 | 5.20 | 0.00 | 5.20 |
| | | avg. | | 2448.0 | 0.750 | 41.2 | 10.1 | 48.7 | 91.0 | 0.16 | 0.45 | 0.25 | 0.35 | 5.40 | 0.25 | 5.65 |
| Natal Plum | Homestead | max. | 30 | 28.8 | 0.982 | 10.4 | 10.7 | 93.4 | 87.1 | 2.09 | 2.57 | 0.63 | 0.38 | 6.63 | 0.03 | 6.66 |
| (*Carissa grandiflora*) | | min. | | 16.1 | 0.928 | 2.4 | 4.2 | 76.9 | 76.2 | 1.57 | 0.52 | 0.22 | 0.30 | 5.19 | 0.00 | 5.19 |
| | | avg. | | 23.4 | 0.964 | 7.0 | 6.5 | 86.5 | 81.4 | 1.83 | 1.56 | 0.45 | 0.31 | 5.99 | 0.01 | 6.00 |
| White Sapote | Key Largo | max. | 8 | 169.1 | 0.979 | 8.0 | 7.8 | 84.9 | 84.5 | 0.77 | 0.66 | 1.26 | 0.84 | 11.81 | 5.20 | 13.15 |
| (*Casimiroa edulis*) | | min. | | 119.1 | 0.957 | 7.5 | 7.2 | 83.3 | 78.0 | 0.44 | 0.50 | 0.98 | 0.51 | 7.40 | 2.20 | 12.65 |
| | | avg. | | 144.1 | 0.969 | 7.8 | 7.6 | 84.6 | 82.1 | 0.62 | 0.60 | 1.17 | 0.73 | 10.77 | 2.27 | 13.04 |
| White Sapote | Bradenton | avg. | 2 | 194.6 | 0.983 | 16.3 | 14.7 | 69.0 | 77.1 | 1.53 | 0.77 | 1.00 | 0.61 | 6.48 | 7.32 | 13.80 |
| (*Casimiroa edulis*) | | | | | | | | | | | | | | | | |
| Loquat | Gainesville | max. | 18 | 19.4 | 1.048 | 22.7 | 11.3 | 69.7 | 89.3 | 2.40 | 0.20 | 0.54 | 0.48 | 4.66 | 4.50 | 9.70 |
| (*Eriobotrya japonica*) | | min. | | 14.0 | 1.017 | 19.4 | 9.3 | 65.2 | 82.7 | 0.95 | 0.06 | 0.32 | 0.26 | 3.61 | 2.98 | 6.59 |
| (Japanese) | | avg. | | 15.5 | 1.034 | 21.4 | 10.3 | 68.3 | 85.7 | 1.60 | 0.13 | 0.40 | 0.36 | 3.91 | 4.38 | 8.29 |
| Loquat | Gainesville | max. | 12 | 18.4 | 1.052 | 32.1 | 18.4 | 65.9 | 89.9 | 1.94 | 0.32 | 0.90 | 1.10 | 5.06 | 4.80 | 9.90 |
| (*Eriobotrya japonica*) | | min. | | 12.6 | 1.032 | 26.4 | 13.2 | 52.3 | 81.6 | 0.80 | 0.16 | 0.37 | 0.30 | 2.94 | 3.20 | 6.70 |
| (Chinese) | | avg. | | 15.8 | 1.048 | 28.3 | 14.7 | 57.0 | 87.0 | 1.60 | 0.24 | 0.64 | 0.48 | 3.21 | 4.41 | 7.62 |
| Rose Apple | Homestead | max. | 20 | 18.9 | 0.766 | 24.2 | 6.7 | 82.1 | 84.1 | 0.60 | 0.71 | 0.94 | 0.47 | 8.45 | 4.80 | 12.60 |
| (*Eugenia jambos*) | | min. | | 15.3 | 0.746 | 13.9 | 3.4 | 72.3 | 78.8 | 0.10 | 0.51 | 0.31 | 0.13 | 6.70 | 2.40 | 8.45 |
| | | avg. | | 17.0 | 0.754 | 16.4 | 5.4 | 78.2 | 81.7 | 0.50 | 0.56 | 0.62 | 0.29 | 7.36 | 2.89 | 10.25 |
| Rose Apple | Lake Placid | avg. | 6 | 16.9 | 0.772 | 23.5 | 16.6 | 59.9 | 82.0 | 0.58 | 0.32 | 0.48 | 0.51 | 7.20 | 2.70 | 9.90 |
| (*Eugenia jambos*) | | | | | | | | | | | | | | | | |
| Java Plum | Homestead | max. | 18 | 7.3 | 1.116 | 27.5 | 11.9 | 77.6 | 86.6 | 1.24 | 0.41 | 0.66 | 0.17 | 12.34 | 0.23 | 12.34 |
| (*Eugenia jambolana*) | | min. | | 4.0 | 1.083 | 11.7 | 10.4 | 62.1 | 77.5 | 0.60 | 0.12 | 0.36 | 0.14 | 09.81 | 0.00 | 10.04 |
| | | avg. | | 5.1 | 1.105 | 19.1 | 11.0 | 69.9 | 83.2 | 1.09 | 0.26 | 0.47 | 0.15 | 11.38 | 0.07 | 11.45 |
| Surinam Cherry | Homestead | max. | 18 | 6.6 | 1.039 | 20.4 | 7.4 | 79.0 | 92.4 | 0.72 | 0.60 | 1.10 | 0.30 | 3.83 | 1.37 | 4.43 |
| (*Eugenia uniflora*) | | min. | | 5.5 | 1.020 | 13.5 | 5.5 | 74.1 | 90.7 | 0.38 | 0.20 | 0.59 | 0.21 | 2.42 | 0.47 | 3.00 |
| | | avg. | | 6.1 | 1.030 | 17.8 | 6.3 | 75.9 | 91.7 | 0.60 | 0.36 | 0.79 | 0.25 | 3.10 | 0.81 | 3.91 |
| Feijoa | Gainesville | max. | 12 | 12.4 | 1.029 | 14.8 | | 93.9 | 85.6 | 0.63 | 0.32 | 1.10 | 0.75 | 3.48 | 1.76 | 4.95 |
| (*Feijoa sellowiana*) | | min. | | 8.3 | 1.015 | 6.0 | | 85.2 | 80.1 | 0.10 | 0.20 | 0.66 | 0.50 | 2.40 | 1.10 | 3.98 |
| | | avg. | | 11.6 | 1.026 | 11.4 | | 88.6 | 84.6 | 0.30 | 0.24 | 0.80 | 0.58 | 2.68 | 1.52 | 4.20 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | avg. | | 6.1 | 1.030 | 17.8 | 6.3 | 75.9 | 91.7 | 0.60 | 0.36 | 0.79 | 0.25 | 3.10 | 0.81 | 3.91 |
| Feijoa (*Feijoa sellowiana*) | Gainesville | max. | 12 | 12.4 | 1.029 | 14.8 | 93.9 | | 85.6 | 0.63 | 0.32 | 1.10 | 0.75 | 3.48 | 1.76 | 4.95 |
| | | min. | | 8.3 | 1.015 | 6.0 | 85.2 | | 80.1 | 0.10 | 0.20 | 0.66 | 0.50 | 2.40 | 1.10 | 3.98 |
| | | avg. | | 11.6 | 1.026 | 11.4 | 88.6 | | 84.6 | 0.30 | 0.24 | 0.80 | 0.58 | 2.68 | 1.52 | 4.20 |
| Fig (*Ficus carica*) | Gainesville | max. | 12 | 14.3 | 0.945 | 1.2 | 1.8 | 98.9 | 84.2 | 0.15 | 0.89 | 0.72 | 0.51 | 12.60 | 1.25 | 13.40 |
| | | min. | | 10.2 | 0.854 | 1.0 | 0.9 | 95.0 | 83.7 | 0.10 | 0.49 | 0.60 | 0.40 | 9.10 | 0.40 | 09.20 |
| (Celeste) | | avg. | | 12.4 | 0.900 | 1.1 | 1.4 | 97.5 | 83.9 | 0.12 | 0.66 | 0.68 | 0.46 | 10.06 | 0.82 | 10.88 |
| Fig (*Ficus carica*) | Gainesville | max. | 12 | 15.9 | 0.988 | 4.2 | 6.7 | 92.3 | 85.9 | 0.90 | 0.60 | 0.78 | 0.90 | 12.21 | 1.06 | 13.10 |
| | | min. | | 12.0 | 0.950 | 1.6 | 2.6 | 85.1 | 83.2 | 0.12 | 0.41 | 0.30 | 0.38 | 10.40 | 0.75 | 8.25 |
| (Ischia) | | avg. | | 13.7 | 0.960 | 3.7 | 5.6 | 90.7 | 84.8 | 0.25 | 0.48 | 0.52 | 0.51 | 11.20 | 0.80 | 12.00 |
| Governor's Plum (*Flacourtia ramontchi*) | Homestead | max. | 5 | 5.6 | 1.100 | 27.3 | 15.2 | 67.4 | 82.6 | --- | --- | 0.34 | 1.10 | 18.15 | 1.85 | 19.74 |
| | | min. | | 4.2 | 1.086 | 18.4 | 10.4 | 59.9 | 76.2 | --- | --- | 0.24 | 0.72 | 15.20 | 0.80 | 15.72 |
| | | avg. | | 4.9 | 1.099 | 25.0 | 13.9 | 61.1 | 80.4 | --- | --- | 0.28 | 0.94 | 16.29 | 1.72 | 18.01 |
| Mangosteen (*Garcinia livingstonia*) | Homestead | max. | 8 | 18.8 | 0.950 | 24.8 | 9.5 | 70.0 | 87.5 | 1.80 | 0.39 | 0.72 | 0.30 | 8.90 | 0.90 | 9.80 |
| | | min. | | 15.2 | 0.930 | 20.1 | 8.1 | 63.5 | 85.1 | 1.27 | 0.20 | 0.34 | 0.21 | 8.60 | 0.00 | 8.60 |
| | | avg. | | 17.0 | 0.941 | 23.2 | 8.9 | 67.9 | 86.3 | 1.50 | 0.27 | 0.64 | 0.23 | 8.65 | 0.50 | 9.15 |
| Pitaya (*Hylocereus undatus*) | Homestead | max. | 4 | 203.5 | 0.999 | 6.9 | 34.6 | 76.4 | 89.2 | 1.21 | 1.21 | 1.63 | 0.58 | 3.36 | 1.51 | 4.87 |
| | | min. | | 184.1 | 0.988 | 2.4 | 19.3 | 62.0 | 83.4 | 0.30 | 0.30 | 1.40 | 0.30 | 2.65 | 1.05 | 3.70 |
| | | avg. | | 195.9 | 0.996 | 3.7 | 25.4 | 70.9 | 87.6 | 0.70 | 0.99 | 1.54 | 0.41 | 3.24 | 1.25 | 4.49 |
| Litchi (*Litchi chinensis*) | Homestead | max. | 15 | 15.6 | 1.086 | 19.8 | 9.9 | 78.1 | 80.8 | 1.32 | 1.60 | 1.30 | 1.00 | 7.30 | 6.90 | 14.12 |
| | | min. | | 15.0 | 1.064 | 12.0 | 9.3 | 70.1 | 76.5 | 0.96 | 0.50 | 0.20 | 0.50 | 6.00 | 4.20 | 12.99 |
| | | avg. | | 15.3 | 1.072 | 15.9 | 9.6 | 74.5 | 78.2 | 1.20 | 0.97 | 0.94 | 0.69 | 6.89 | 6.68 | 13.57 |
| Mammee Apple (*Mammea americana*) | Florida Keys | avg. | 2 | 1409.6 | 1.011 | 30.7 | 17.3 | 52.0 | 88.7 | 3.43† | 0.86 | 0.72 | 0.27 | 2.57 | 1.43 | 4.00 |
| Ceriman (*Monstera deliciosa*) | Homestead | max. | 5 | 365.2 | ---- | 17.9 | 31.4 | 57.6 | 81.9 | 1.03 | 0.43 | 1.59 | 1.50 | 13.22 | 1.08 | 13.62 |
| | | min. | | 298.6 | ---- | 15.0 | 27.6 | 50.2 | 77.6 | 0.65 | 0.18 | 0.95 | 0.97 | 09.62 | 0.30 | 9.98 |
| | | avg. | | 305.9 | ---- | 17.1 | 29.0 | 53.9 | 80.6 | 0.80 | 0.32 | 1.45 | 1.29 | 10.14 | 0.42 | 10.56 |
| Barbados Gooseberry (*Pereskia aculeata*) | Homestead | max. | 6 | 56.1 | 0.957 | 15.3 | 18.9 | 72.6 | 94.8 | 0.88 | 0.12 | 1.11 | 0.48 | 2.78 | 0.30 | 2.83 |
| | | min. | | 40.2 | 0.910 | 13.2 | 15.3 | 65.0 | 86.2 | 0.65 | 0.00 | 0.94 | 0.38 | 2.40 | 0.00 | 2.40 |
| | | avg. | | 48.7 | 0.929 | 14.0 | 17.0 | 69.0 | 93.1 | 0.78 | 0.02 | 1.06 | 0.40 | 2.55 | 0.19 | 2.74 |
| Guava (*Psidium cattleianum*) | Gainesville | max. | 12 | 13.2 | 1.056 | 14.8 | 90.7 | | 87.9 | --- | 1.35 | 1.02 | 1.05 | 1.50 | 3.16 | 4.55 |
| | | min. | | 09.8 | 1.019 | 09.3 | 85.2 | | 77.4 | --- | 0.49 | 0.77 | 0.52 | 1.00 | 2.40 | 3.70 |
| (Yellow Cattley) | | avg. | | 12.2 | 1.020 | 10.3 | 89.7 | | 84.2 | --- | 0.67 | 0.80 | 0.75 | 1.32 | 3.00 | 4.32 |
| Guava (*Psidium cattleianum*) | Gainesville | max. | 12 | 12.3 | 1.069 | 8.6 | 95.8 | | 85.6 | --- | 1.06 | --- | 1.20 | 3.60 | 6.31 | 7.63 |
| | | min. | | 09.6 | 0.998 | 4.2 | 91.4 | | 81.2 | --- | 0.40 | --- | 0.55 | 1.32 | 1.27 | 4.21 |
| (Red Cattley) | | avg. | | 11.1 | 1.007 | 6.0 | 94.0 | | 84.9 | --- | 0.46 | --- | 0.75 | 1.50 | 2.92 | 4.42 |
| Guava (*Psidium guajava*) | Homestead | max. | 6 | 16.3 | 1.098 | 23.8 | 84.7 | | 87.9 | 0.72 | 0.69 | 0.89 | 0.77 | 2.45 | 3.04 | 5.40 |
| | | min. | | 14.2 | 1.000 | 15.3 | 76.2 | | 80.6 | 0.24 | 0.27 | 0.51 | 0.42 | 1.33 | 2.42 | 4.23 |
| (Common) | | avg. | | 15.6 | 1.030 | 20.0 | 80.0 | | 86.1 | 0.30 | 0.57 | 0.79 | 0.48 | 1.69 | 2.77 | 4.46 |
| Pomegranate (*Punica granatum*) | Gainesville | max. | 6 | 496.3 | 0.946 | 39.4 | 25.1 | 63.7 | 84.6 | 1.20 | 1.00 | 0.75 | 0.77 | 3.40 | 3.90 | 6.90 |
| | | min. | | 220.2 | 0.900 | 27.6 | 10.3 | 48.9 | 80.9 | 0.92 | 0.78 | 0.39 | 0.39 | 2.10 | 3.00 | 5.77 |
| (Wonderful) | | avg. | | 459.0 | 0.932 | 31.3 | 14.5 | 54.2 | 82.6 | 1.18 | 0.92 | 0.51 | 0.61 | 2.30 | 3.60 | 5.90 |
| Tamarind (*Tamarindus indica*) | Homestead | max. | 24 | 10.1 | 0.869 | 53.5 | 28.5 | 45.3 | 38.0 | 9.10† | 1.63 | 3.54 | 13.21 | 28.40 | 0.62 | 28.25 |
| | | min. | | 7.4 | 0.508 | 30.5 | 18.9 | 27.6 | 21.4 | 6.56† | 0.55 | 2.59 | 10.42 | 16.29 | 0.00 | 16.84 |
| | | avg. | | 9.8 | 0.644 | 37.4 | 24.9 | 37.7 | 30.4 | 8.03† | 1.26 | 2.73 | 12.60 | 21.16 | 0.22 | 21.38 |
| Jujube (*Ziziphus jupuba*) | Homestead | max. | 10 | 4.8 | 0.9788 | 15.4 | 29.6 | 68.9 | 78.6 | 0.75 | 1.10 | 1.33 | 1.05 | 6.20 | 7.01 | 13.20 |
| | | min. | | 3.1 | 0.9590 | 12.6 | 15.3 | 58.4 | 70.8 | 0.51 | 0.10 | 0.80 | 0.48 | 4.62 | 5.60 | 10.04 |
| (Indian) | | avg. | | 4.0 | 0.9683 | 13.1 | 23.6 | 63.3 | 74.2 | 0.62 | 0.40 | 0.97 | 0.54 | 5.54 | 6.17 | 11.71 |

*Fruit sampled over period of four years, 1931-35. Two or more years represented in each figure.
†Acid calculated from weight of dry pulp.
‡(1 oz. = 28.4 grams) (1 lb. = 454 grams)

uents, but is as high or higher than that of the more popular temperate fruits. The ash is largely made up of iron, calcium, potassium, sodium, magnesium and silica, with traces of all the other elements.

Carbohydrates, of which the most important are the starches in immature and sugars in mature fruits, are the chief constituents in most fruits. The amount of sugar present in any given fruit depends on its stage of maturity. The starch present in most green fruits is high, but, as the fruit ripens. the starch decreases until, in the ripe fruit, it disappears, while the sugars increase with maturity. All of the fruits analyzed being fully mature, the sugar content was high in most of them. The tropical fruits appear to have a higher sugar content on the whole than do the temperate fruits. In guavas, loquats, feijoa, etc., large amounts of pectin are found, especially in the unripe fruit. The material causes concentrated water extracts of the fruits to gelatinize and form jelly, thus giving a higher value to these fruits.

The figures given in the tabulated forms represent the composition of the fruits as they are eaten. They should be of value to the research man, dietician, plant breeder, grower and housewife alike. The complete data are now being compiled and will shortly be made available in bulletin form to all interested.

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Dr. Fairchild: I am much interested in the mango and I see there is a difference in the acid, ranging from 13 to 71 in the same general group. That is a very great difference. I would like to ask Dr. Stahl how he tells when a mango is ripe. Have you a graph showing when a mango is ripe?

Dr. Stahl: I am sorry we do not have this data on the life cycle of the mango. These represent the fruit as mature and our test was the thumb test on these mangoes. It may be somewhat off, but in all cases the fruit was eatable. Those not eatable were not analyzed. I am sorry we do not have data from the very small mango to the ripe mango. It would be very interesting.

Dr. Fairchild: I had an experience with the Averrhoa bilimbi. It is a very remarkable fruit in the amount of juice it has and a very thin skin, looks about the size of a man's finger, and a single one of those fruits has more juice in it than a big lime. It seemed to me so interesting I made a salad of it and we all liked it, so I submitted it to Dr. Kellogg and I said, "Here is a new acid fruit for you," and he fired it up to Battle Creek and they analyzed it and I was anticipating his report. It is oxalic acid, according to his statement, and that is taboo in Battle Creek sanitarium. I was wondering—you have here the carambola, under citric acid. I will bet any of the fruits you examined had oxalic acid.

Dr. Stahl: The total acid was submitted as citrus acid in order to have some means or measure that would be fair to all the fruits; we chose citric acid as a basis and took that in figuring up the percentage of the acid of all the fruits, so that when it says per cent. acid, citric, it does not mean all that is citric acid, but the figures represented in the table, the acid was figured as citric acid and not sulphuric or some other acid.

Question: What is your impression—that the mango has oxalic acid in it?

Dr. Stahl: It does not taste like it. It would have to be figured out.

Question: I would like to ask if you made any test as to the percentage of acid in the carambola?

Answer: No. I would like to make a statement that we will be glad to analyze any of these fruits for interested growers, because we are interested in getting a complete list of tropical fruits; and any one who would wish to have a complete analysis on one of these fruits, we would be glad to include it in our test.

# THE DECEMBER FREEZE AND RESULTING DAMAGE TO TROPICAL FRUITING PLANTS IN LEE COUNTY, FLORIDA

**A. H. Andrews, Estero**

Not since February, 1917, has Lee County, Florida, experienced so damaging a cold spell as that of last December 11th and 12th, which resembled the freeze of 1917, both in duration and intensity, though somewhat more erratic in performance than its predecessor. Thermometer reading at sunrise in Estero on Wednesday, Dec. 12th, showed an average low of 29°, and 27° on the morning of Thursday, Dec. 13th. In an exposed location another thermometer, hung on a stake near the ground level, recorded temperatures of 26° and 22° respectively.

Though the cold of Tuesday night seemed more intense and penetrating, little damage was evident the following morning, owing to the high wind that prevailed which prevented frost from settling, though some traces of ice were seen. Wednesday night the weather was still and cold, leaves of tender trees and shrubs were drooping, like flags at half mast, and the air was redolent with the pungent odor of withering vegetation. It was withal a discouraging spectacle.

There are a great variety of rare and little known tropical fruits to be found in South Florida, but as a rule, these are scattered over a wide area as individual dooryard plants, so that the average individual has no opportunity of familiarizing himself with them. For some years past it has been the ambition of the speaker, and associates, to establish in the extensive park grounds of The Koreshan Unity at Estero a complete collection of little known and worthwhile tropical fruiting plants which may prove adapted to soil and climate conditions of this region.

The site of this experimental planting comprises a large acreage of high hammock land, with yellow subsoil, and underlaid with clay and limestone. It is situated on the banks of Estero River, a tidewater stream, with an elevation of twelve to fifteen feet above the water level, thus insuring adequate drainage during the rainy season.

It is a well known fact that high hammock land is usually colder than the flatwoods. Sites on the islands or bordering the coast, with water protection to the northward, offer greater immunity from frost, but as a rule they have insuffient elevation to insure adequate drainage in times of excessive rainfall or of tidal overflow. Many tropical fruiting plants primarily require drainage, lacking which they soon wither and die. Lack of drainage is therefore an insurmountable handicap. Freezing temperature, on the other hand, is rarely experienced in Lee County, and to a limited extent may be guarded against. Also as trees grow larger they become more resistant to cold.

Enumerated herewith are thirty-seven different kinds of tropical fruiting plants, other than citrus, to be found on the grounds of The Koreshan Unity at Estero. Many were small plants of recent introduction and only about half the number had reached bearing age prior to the December freeze. The smaller plants, for the most part, were in a slat shed which insured some degree of protection, larger specimens being set in the open ground.

I have referred to the December freeze as freakish in character. For instance, a large bearing Guava tree would be killed to the ground while one of equal size standing nearby would be frozen back to main branches only. Large bearing Mango and Avocado trees were killed back to main limbs and in only one instance do I recall a large Avocado deadened to the ground. The White Sapota in degree of cold resistance proved one of the big surprises, as a tree of some fifteen feet in height was practically uninjured. Small ones, of course, were killed to the ground.

Exposed bushes in our large Surinam Cherry thicket were badly frozen, while protected ones inside the patch were comparatively uninjured. Though the blooming season has arrived, these have so far shown no sign of fruiting. Large

bushes of the Ceylon Gooseberry (Dovyalis hebecarpa), though fairly hardy, were frozen to the ground. This is a slightly tart fruit about the size of a small marble and is wonderfully fine for jelly and preserves.

An old bearing Tamarind tree was frozen back to the main branches. A bearing size Otaheite Gooseberry met with a similar fate. A bearing size tree each of Mountain Sour Sop, Eggfruit, Litchee, Para Guava, Jatropha curcas and Sugar Apple were killed to the ground. A number of young trees of Governor's Plum were also frozen. It is encouraging to note, however, that practically all of these frozen plants, whether large or small, are sprouting again from the root, so that little may be counted as a total loss. List of these tropical fruiting plants now growing at Estero on the premises of The Koreshan Unit is as follows:

Akee (Cupania sapida); Avocado (Persea americana); Annona muricata—Mountain Sour Sop; Annona (unknown variety); Banana; Bael Fruit; Barbados Cherry (malpighia glabra); Carambola (Averrhoa carambola); Carissa (Amatungula); Chrysophyllum—native of lower East Coast Hammocks; Dillenia indica; Eggfruit (Lucuma nervosa); Feijoa sellowiana; Governor's Plum; Golden Sapota; Green Sapota; Cattley Guava; Common Guava; Jatropha curcas; Jambos (Eugenia jambos); Jujube (Zizyphus); Kaffir Bean; Litchee; Mango; Mexican Fig; Natal Plum; Otaheite Gooseberry; Pistachio Nut; Para Guava; Sapodilla; Sugar Apple; Surinam Cherry; Tamarind and White Sapota.

Extensive Mango groves on Pine Island were uninjured by the December freeze and the trees are now setting a heavy crop of fruit, but this section enjoys unusual protection from the waters of Boca Grande Pass and Charlotte Harbor to the north and west. The same is largely true of the Iona section of the mainland bordering the lower Caloosahatchee River. In Fort Myers the protection of this broad river to the northward is very marked for several blocks distant. But even on the water front there are occasional Mango and other large tropical trees that were severely nipped by that freakish freezing temperature. Farther inland the cold damage was much more severe than near the coast.

We are accustomed to think of cold temperature moderating in proportion as one travels south, but the December freeze seemed to have broken all records in unusual performance. Shortly after this destructive visitation I motored over to West Palm Beach and was surprised to find comparatively little resulting damage. At Miami frosted vegetation was more in evidence. Coral Gables looked much the worse for the experience, but Homestead appeared to have been hit hardest of all. Some weeks later, Walter M. Buswell, botanist with the University of Miami, motored way down to Cape Sable and reported that frost damage there was the worst he had seen anywhere, even the Buttonwood trees being badly frozen.

There is little that one can do in the way of first aid to frozen trees. If the seared leaves drop readily from twigs and branches you may be encouraged to know that the wood is not dead, sap is circulating normally and new buds are pushing to take the place of the old dead foliage. If the dead brown leaves fail to drop, adhering tightly to the branches, you will know that the said branches are dead. In such a case it is better to keep hands off for awhile. In course of time Nature will indicate by the pushing buds just how far the living wood extends and where to cut away the dead wood. Many a tree has been needlessly ruined by precipitate action in cutting away large portions before it was definitely determined just how far back it was injured.

Fertilization and plentiful watering immediately following a freeze are also hazardous, inasmuch as they tend to stimulate rank new growth which is liable to be frosted again before the winter season is over. The best that I can suggest in the treatment of frozen trees is to puruse a watchful waiting policy. It may be hard to do at times, but it is the safest in the long run, for Nature will ultimately indicate just how far to cut them back. Then, when danger of frost is fully over, water and fertilizer may be applied without fear of damage to them.

Mr. Brooks: The damage to mangoes was very freakish. Frosts are always freakish. We found that even in the same grove, with the same care and apparently the same conditions, mango trees were variously injured. We found, rather to our surprise, that when the Hadens were badly frozen back the blossoms would come out from those stubs. Whether or not that fruit will hold, we don't know, but the bloom is coming out. I think that is about all I have to say. Thank you very much.

Next speaker was Waldo E. Sexton, Vero Beach, on the same subject.

Mr. Sexton: I got the impression that the information you wanted was in previous years and the freezes of 1895 and damage done at that time and plants that came through and I had hoped to have here today a group of men who lived here for fifty or sixty years, to report, but they have all fallen down and not shown up. I had one man here 35 years who left.

But I have talked to these men and since you are covering this year's freeze, I am going to report for the Indian River area in previous freezes. Information from old growers is that in this immediate vicinity there were very few groves in 1895. Those groves were unhurt. These same old groves were not hurt in 1917 and were not hurt in the last freeze.

The West Indian avocado, in some areas, were hurt and some killed to the ground. The avocados I have been playing with, some of the bottom leaves were hurt, but most were undamaged and are setting wonderful crops of fruit. Some mangoes were killed, some not. My impression is that back in the early freeze of 1895 there were very few mangoes or avocados or any fruit of that character here to observe. I am sorry these men are not here and that is about all the information I can give you.

Mr. Andrews: I might add I first came to Lee County about 40 years ago and was there during the 1895 freeze and that was the very impetus given to citrus growing in the county, when growers came from up the state and marveled to see trees of bearing size still alive. Fruit was shipped from Lee County after that freeze and grapefruit brought $12 a box at that time, I am told. There were a lot of seedling mangoes and avocados and the avocados were tender and so far as I know they were killed to the ground.

Mr. E. G. Wilkinson, Naples: I can enlighten you somewhat on your local conditions. Fifty-two years ago the last orange grove on the south was at Sebastian. What went wrong with these groves I don't know—when I looked for them in 1912 they were not there.

Question: You say there were no orange groves here in 1912?

Mr. Wilkinson: As far as I know.

From Floor: There are five seedling trees on the Walker place. He tells me they were growing when the 1895 freeze came and they still are today.

Mr. Wilkinson: I would not say there wasn't an orange tree back in the country, for all our travel was by boat, but there were none in fruit.

Mr. Gifford: Vero Beach reports they had a grove at that time and it was unhurt in 1895 and they state that the West grove on the ridge was growing at that time.

Mr. Wilkinson: Understand, I am talking about '82 and '83.

Mr. Sexton: Well, that's beyond me.

Mr. Ward: Mr. Chairman and Gentlemen: I am not going to be long, but I will say that the experience in the Avon Park section has been similar to other areas of the state. It did not get as cold in my particular section and grove as in some sections. We only had one thermometer register 26 degrees. Most of them registered 29 degrees.

Several years ago in the '27 freeze, I reported to the Society that in some small Taylor and Lulu avocado trees there seemed to be no difference, if any, in favor of the Taylor. I think they doubted my word. However, this last winter has clearly demonstrated in every place in the state where they had the two varieties. The older trees are not hurt except for a few limbs on the majority of the varieties. One West Indian variety of avocado that almost kills itself bearing originated near Fort Myers. It was badly injured at a temperature of 28 degrees. We had two or three other varieties—the Queen showed no effects of the cold, but as far as fruit is concerned, I

would just as soon not have any trees. It may turn out to be good for root stock. It did not have a leaf turned on it, showing how much cold it could stand.

Itzamnas stood cold well and proved to be very fair bearers in the ridge section, with the exception of two trees out of about fifty or sixty that bear well. It is possible, by selection, we might have something worth while. I noticed in all varieties some trees will bear quite heavily in consecutive years. Those are the trees from which we will select bud and graft wood, trying to get improvement in varieties. So far as standing cold, the Taylor was best and the Lulu second and a little behind that was the Winslow. You remember the Winslows were severely criticized here two years ago, however, it is possible that those men who have Winslow trees may yet come out right if our truck trade to Georgia and Carolina holds out. Quite a few are bought to take up with early oranges. They ship well and the Georgia and Carolina people were very well pleased. Many of those people feel the bigger the fruit the better it is and as long as they feel that way there is an outlet for this fruit.

Of the comparison between the bearing qualities of the Winslow and the Collinson, the Winslow has borne, I am sure, from fifty to one hundred per cent. more than the Collinson. It is a beautiful fruit. There are some undesirable trees you can keep away from in our section and in mine it is the Queene and the Fuerte. The latter won't bear shipping. It ripens too quickly for common production.

Sugar maple trees several years old did not have the leaves turned this year. There has nothing been said concerning the treatment of trees following the cold. What has been said is correct as to leaving them alone till you find out just how much damage is done. Limbs that look dead will put out a good growth afterwards. However, I believe every man when he cuts them back should whitewash the rough trunks and main part of the trees thoroughly, using either the government formula or the W. H. formula. It will save sunburn. We have found definitely how severe that sunburn can be to big old trees fifteen or sixteen years old—three hours in the afternoon will blister many a tree with bark half an inch thick.

Taylor is the most profitable variety we have. We have kept records of sales for the last five or six years. Lulu is a close second. Professor Stevens has been doing splendid work in getting up spray mixtures for mangoes and avocadoes. We are carrying out the schedule as outlined by him in our grove this year and we will finish our second spraying of Bordeaux. Probably three more sprayings to eliminate black spot on those varieties will be required. I think that covers the remarks from the ridge section.

## SYMPOSIUM ON COLD INJURY TO AVOCADOS, MANGOS AND 'OTHER SUB-TROPICAL FRUITS AND THEIR CARE

**Chas. H. Steffani, Homestead**

Weather conditions that cause temperatures of a freezing nature in South Florida offer a wide field for study. When freezing weather prevails in the temperate zones, all crops and tender plants are frozen and nothing seems to be missed by Jack Frost, the term generally used for such conditions.

In South Florida, conditions seem to be different. I have had occasion to observe frost conditions in Dade County in the freeze of February 6, 1917, and the recent freeze of December 14, 1934, and I have observed so many freakish things that nature has played that I am perfectly willing to leave it to others to draw their own conclusions.

How is anyone to draw any definite conclusions on how hardy or tender a plant may be when upon investigation you observe a planting of street

trees, all the same variety, all the same size, and in the length of one-half mile, four trees are killed in different spots, scattered here and there on both sides of the road, and leave the rest in perfect condition, without a leaf damaged? Who knows what was the reason for three or four rows of Persian lime trees to be killed outright at an angle of forty-five degrees through a grove, and not kill hardly any on either side, and then jump across the road and take four trees off the edge of another lime grove, and leave all the rest of the trees in that grove not touched? How are we going to account for a row of Mangos growing on one side of a road that were frozen back six feet, and on the other side of the road trees of the same size and variety not damaged at all? What is the answer, when you walk through a lime grove and find some trees entirely killed, and surrounding these trees others that were not damaged at all? What is the answer to the question, when you find hardy Guatemala avocados in one grove badly damaged, and West Indians next to them hardly hurt, and in adjoining groves just the opposite condition. And those same varieties of Guatemala avocados, we find will stand in snow banks on the California hillsides without being damaged from cold.

How is anyone to give a correct answer when frost will draw a straight line across a field of potatoes, just like you laid a ruler down and drew a straight line across a piece of paper, and on one side the plants entirely frozen to the ground and on the other side no damage, and every plant perfect.

I may go and recite a good many such cases. A great many theories have been advanced, some say fertilizer practices play an important part, others say some plants are hardier than others, and we should select for cold resistance, whatever the answer may be. We all have to admit that nature has a freakish way of doing things in South Florida.

Some have advanced the idea that fertilizer practices played some part in this freakish turmoil of conditions. From observation made avocado groves fertilized continuously with regular formulas high in organic ammonia, three or four times a year, suffered just as bad as those receiving one application a year of regular formlas and other applications of Sulphate of Ammonia. Taylor variety that came through with practically no damage, stood up just as well where they had been fertilized the past three years with Sulphate of Ammonia, as they did where fertilized with regular organic avocado formulas.

Contrasting difference in time of year and weather conditions between the freeze of February 6, 1917, and the one of December 13, 1934, is no doubt worthy of consideration. At the time of the freeze of February, 1917, we were on the verge of Florida spring, and shortly afterward heavy rains occurred; latter part of February and during March three and one-half inches of rain fell in Dade County, and heavy rains continued through April, May and June, (April 3.74 inches, May, 4.62, June, 6.71, September, 18.0) with the result in a short time that avocados, mangos and other tropical fruit trees frozen back had more than gained the wood lost from the freeze. The cold spell of the past year, we have a different condition occurring in the middle of winter, when all plants were dormant, and with continued dry cold weather trees did not respond as quickly, even under irrigation. When new growth appeared, it was short and not vigorous, the tendency was for a tree to shoot forth blooms rather than vigorous new growth. Mango crops are the largest they have been for a number of years. Avocados have an excellent bloom, as well as limes. If rainfall had occurred shortly after the freeze there would have been less dead wood, and trees would have responded with little damage. Pruning is not so important until new growth has started, and can be done anytime in late spring on citrus or mangoes. On avocados the situation is different, pruning should be done before the hot weather or rains set in, otherwise dying back of the branches will continue during the summer.

In summarizing the situation and comparing the two cold winters of 1917 and 1934, I am of the opinion that rainfall is the most important factor in tree response after freezing temperatures.

# A PALMETUM IN SOUTH FLORIDA

**Col. Robert Montgomery, Coconut Grove**

I am here this afternoon as an exhibit. One of the objects of the Krome Institute is to interest amateurs in the horticultural game, and in thinking over all the amateurs he knew, he selected the most ignorant one of all, because he thought if I could only get by with it this afternoon it might encourage others. And while he was talking about the emergents and I was trying to think if any would apply to me, it occurred that an emergent might be in the form of greater leisure. But I think that, in this changing world of ours, if we are to believe that machinery is to continue to have its place and if the labor laws go through as we believe they will, there will be a great increase in leisure. In my own case, I was a casual visitor to Florida up to a few years ago. I came down in January and went back in March and did not know much more about the state when I went back than when I arrived.

Mr. George Brent, who went to Coconut Grove, talked to me in Connecticut about coming down here and starting a collection of palms. He said I might be surprised to hear that in Florida at that time there was no substantial collection of palms and he thought that it was not only surprising but a calamity, because he said that he had become interested in them to a certain extent and he believed that the palm is the greatest tree in the world, that it has more uses, more commercial uses, more aesthetic uses, than anything else at all comparable. He said there were very many species of palms that have never been grown in Florida at all and that if I wished to use my leisure it would not be difficult to assemble a collection of palms that would give me much pleasure and might result in an interesting hobby for those who, like myself, might be inclined to spend our additional leisure in doing something else than playing golf. To make a long story short, I traveled through the southern part of the state and was told, if I were going to raise all kinds of palms, I needed low land and high land and hammock land and salt water and fresh water, because there alone would be five varieties of soil and wind protection and that all those five elements would be needed in any representative collection of palms.

As I did not want it to look like a nursery, I toured the state and secured as many large specimens of palms as I could to start my collection. I was fortunate in finding on the west and east coast quite a number of introduced as well as native varieties. I was also surprised at the interest in palms in various parts of the state. In Orlando I was told that about fifty years ago they had a Palm Society and every member of the society was supposed to bring in some new species of palm from some part of the world and many of them did. I asked about the archives of that society and was told some one had them and would write it up. That was three years ago and nothing has been done about it. If there is any one here from Orlando, I think that something should be done about this Palm Society.

That interested me a lot in Orlando, so I devoted more time to that section. I knew Dr. Nehrling's collection of palms. I traced it to Naples and found most of them had been disposed of. I visited Dr. Simpson in Miami. He did not have so very many left. He would bring in small palms and raise them from seed and a great many were killed by land crabs and by the hurricane in 1926.

I think what Mr. Brett told me was true—I was unable to find in Florida any considerable collection of palms. I found very soon that I could not possibly bring palms in from other countries. In the old times, when Orlando had its Palm Society, they could pick up a palm 30 or 40 feet high in Cuba or some other tropical country and bring it over. In California there is a collection, rather small as far as the number of species is concerned. They took in 30 or 40 carloads from Mexico. So I have had this great obstruction to overcome, in that I can only bring

in seeds, but I have been able to establish contacts with most of the tropical countries of the world and have brought in about 800 lots of palm seed. During the first year I depended upon the foreign correspondents to send me the seed and in many cases it came in not vital, due to the length of time, methods of packing, etc. So during the past year, I have been sending containers and packing material to every place in the world from which I want seeds and my percentage of germination has enormously increased. At the present time I have something over 300 different species and varieties of palms, many entirely new to this country. I have in process of germination, and with the hope of the plantsman that all will germinate with a reasonable degree of success, I will have probably 200 more species within a year or so. We have averaged one or two new ones a week and with increased germination we will get new specimens faster than ever before, and in addition to that I have greatly increased the number of foreign correspondents. Dr. L. H. Bailey, who has probably the largest herbarium of palms, tells me there are at least 1500 or 1800 different species of palms. I am hoping that within a reasonable time, if I have not achieved that objective, I will have the largest collection of growing palms in the world. I think it is not necessary to try to have the largest, but no one else, apparently, has thought about it before I did and it was about the easiest thing for me to do to have a considerable collection.

What I am hoping to accomplish as one of Dr. Fairchild's exhibits, is that people in Florida will become interested in raising palms that they have not seen before but have heard of. There are so many beautiful specimens among them that it is an extremely interesting hobby for any amateur to have. It would pay in more ways than one just to start a small collection; nothing is easier, because you can get many seeds now and I am hopeful that if what I have done will stimulate the interest of you and your friends here in Florida, it will give me just that much added pleasure.

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Colonel Montgomery was accorded a rising vote of thanks at the close of his talk.

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## MATURITY AND QUALITY IN ACID CITRUS FRUITS

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During the past season preliminary maturity and quality tests on Florida grown acid citrus fruits were carried out for the following varieties: *Perrine, Eureka, Meyer* and *Sperryola* lemons, and *Key, Tahiti, Lakeland* and *Eustis* limes. California grown lemons, bought on the Orlando market were also included. The work was carried on during the heaviest production period in Florida. This period for acid citrus fruits (limes and lemons) in Florida is from July to January. The main crop of limes is produced from July to January (*2, 5, 6*)*; *Key*, July to September; *Tahiti*, July to November; Lakeland and Eustis, September to January. The main maturity period for lemons ranges from August to December (*2, 3, 4, 5, 6*); *Meyer* and *Sperryola*, August to December; *Perrine* and *Eureka*, August to December. Periodic or off-season blooming periods with both lime and lemon varieties results in considerable production during the greater part of the year, especially in seasons free from severe cold periods. Apparently the main Florida crop is not harvested during the period of heaviest lemon production in California (*5*) which is from winter to summer—the *Lisbon* variety through the winter and spring; *Eureka* from late spring through the summer.

*Reference is made by number (italic) to literature cited at end of article.

Varietal maturity and quality were studied in terms of physical fruit characters—weight, shape, thickness of rind and percentage of rind, rag and juice; number of locules, and seeds, color of rind and juice, other miscellaneous characters and physico-chemical characteristics of the juice—total solids, total acids, effective acidity (pH); and organoleptic or taste qualities. The technic has been described elsewhere (*8, 9, 10*). Samples consisting of ten fruits were collected from groves in central Florida (Polk, Hillsboro and Lake Counties) and in south Florida (Dade and Monroe Counties) at approximately fourteen day intervals from August through November. Preliminary observations on the effect of drought on fruit composition were also made. For most varieties the data reported is based on at least five samples or fifty fruits; in no case were less than three samples or thirty fruits utilized in arriving at the values recorded. In the interpretation of the data, formulae suited to rapid machine calculation were used ( *11, 12*).

The usual determination of the solids (sugars) to acids ratio now used in the study of maturity and quality in oranges and grapefruit obviously does not apply here. As often used, the extracted juice undergoes considerable dilution, and the total acids present indicate the greatest extent to which this dilution may be carried and still result in a high class product. The varieties most widely grown in Florida contain a minimum of five per cent. acid for limes and four per cent. for lemons. Aside from such considerations as frost and disease resistance, productivity and keeping qualities, the chief criteria for an ideal acid citrus fruit are concerned with percentage of acid and extractable juice. These latter are here considered briefly, together with other fruit and juice characteristics such as percentage of total solids, taste qualities, size shape and number of seeds.

Among the lime varieties, *Key*, a small acid lime, also called the *Mexican* or *West Indian* lime, is the standard variety (*4*). In recent seasons the *Tahiti* or *"Persian"* lime has come into prominence in Florida, nearly a thousand acres now being planted to this variety. The names *"Bearss Seedless"* and *"Byrum Seedless"* appear to be synonyms for the above variety. Two hybrid varieties introduced by the U. S. Dept. of Agriculture (*6*) as the *Eustis* and *Lakeland* "limequats (lime x kumquat), have been recently propagated for commercial planting. In quality these fruits have proved so nearly identical with the lime parent, though much hardier, that for horticultural and commercial convenience they will henceforth be treated as new varieties of the lime.

*Percentage acid.* As shown in Plate 1, under the conditions of these experiments, *Key* lime had a consistently higher percentage of acid than *Tahiti*, 7.2% for the Key lime as compared with 5.2% to 5.6% for the *Tahiti*. *Lakeland* with 6.1% to 6.4% and *Eustis* with 6.8% held intermediate positions.

*Percentage of solids.* There was no great variation in percentage of total solids for all varieties, 9.9% to 11%, except that *Tahiti*, on rough lemon root-stock, had a comparatively lower percentage of solids, 9.2% (see Plate 1).

*Percentage of juice.* As shown in Table II, the percentage of juice was highest for *Key*, 53.8%. *Tahiti*, grown in Lake County, on different stocks, had from 48.9% to 52.4% as contrasted with the same variety grown in Dade County on rough lemon stock, 43.7%. *Lakeland* lime had a greater percentage, 50.6% to 52.2%, than *Eustis*, 41.8%.

*Riciness.* During the period covered by these experiments riciness was not encountered in the varieties of limes studied.

*Size.* As shown in Table I, *Key* limes, grown in Lake County, averaged 48 grams and 1.7 inches in diameter. *Tahiti* had approximately double this weight, 86 grams to 111 grams and a diameter from 2.1 in. to 2.2 in. *Lakeland* averaged in weight somewhat lower than *Key* with 42 gms. to 45 gms. but had almost the same diameter, 1.6 inches. *Eustis* was the smallest in size, 37 gms. and 1.5 in. in diameter. In terms of fruit per pound the average weights for these varieties would give 9.3 *Key* limes, 4.5 *Tahiti*, 10.4 *Lakeland* and 12.2 *Eustis* fruits per pound.

*Percentage of Rind and Rag.* Along with the tabulated weights are shown the average percentages of rind and rag for each variety. The differences are very slight except that *Tahiti* lime shows a larger per cent. of rind, ranging from 18

to 22 per cent. as compared with other varieties, ranging from 13 to 15 per cent. (See Table II.)

*Shape.* *Key* limes are nearly round as shown by a ratio of length to width of 1.02. *Tahiti,* with ratios from 1.03 to 1.11; *Lakeland,* with ratios from 1.05 to 1.10; and *Eustis* with a ratio of of 1.14 are more elongated. The *Lakeland* and *Eustis,* tapering toward the stem end give the illusion of being more elongate than the actual measurements reveal. (See Table I.)

*Thickness of Rind.* In Table I is presented in tabulated form the average thickness of rind for each variety. It should be noted that the rind of the *Tahiti* variety is approximately twice the thickness of the other varieties tested.

*Number of seeds.* *Tahiti* limes are practically seedless with only nine seeds in a total of 170 fruits examined from various localities. For the other varieties *Lakeland* had an average of nine seeds for two lots and seven seeds for a third lot. *Key* lime grown in Lake County in a mixed planting showed an average of nine seeds; *Eustis* lime under similar conditions averaged twelve seeds. (See Table I.)

*Taste qualities.* Certain of the taste qualities of the extracted juice of citrus fruits have been classified as "acid," "bitter" and "immature" or "raw" (*8*). In the case of acid citrus fruits the first is most important. "Bitter" taste, due to presence of glucosides, and "immature" taste or "rawness" may be perceptible to an objectionable extent.

All limes included in the study were consistently "very sour." The effective acidity (pH) of the juice does not give a completely satisfactory explanation from the organoleptic standpoint as indicated under lemons below. Apparently the importance of a threshold value for taste perception in this case has been overlooked.

The pH for *Key* lime ranged from 2.17 to 2.23 and neither "bitter" or "immature" taste was observed. In *Tahiti* lime, the pH ranged from 2.20 to 2.42, and "immature" taste was found in some of the August samples. The pH ranged from 2.23 to 2.40 ror *Lakeland* and 2.30 to 2.35 for *Eustis.* "Immature taste was present in two early samples of *Lakeland.*

LEMONS

The *Eureka* lemon, a standard variety, is planted to a limited extent in Florida to supply in part local needs. A hybrid variety, the *Perrine,* introduced by the U. S. Dept. of Agriculture in 1931 (*7*) shows promise and in the southern part of the State several hundred acres have recently been planted to this variety. A large fruited, relatively hardy variety, the *Meyer,* a U. S. Dept. of Agriculture introduction from China, is preferred for planting in central and north central Floirda and its planting is now reaching commercial proportions (*3*). A fourth variety, named the *Sperryola,* which is fairly hardy, has found some favor and a number of commercial groves of this variety are now in production in central Florida (*4*).

*Percentage of acid.* *Perrine* and *Eureka,* on rough lemon root-stock, and California lemons bought on the local market, had a similar total acid percentage ranging from 6.2 to 7.2%. *Meyer* on rough lemon and on citrange stocks and on its own roots, holds the intermediate position with a range from 4.3% to 4.8%. *Sperryola,* on rough lemon, falls much too low in percentage of acid, 2.8% to 3.6% for different lots, for classification with commercial lemons. (See Plate 1.)

In dilution tests the juice of fruits having the higher acid content—6% or more—could be diluted 8 to 10 times its original volume without losing the characteristic lemon flavor; with the lower acid range of 3 to 4% a dilution of 4 to 5 times marked about the limit for ade use.

The acid percentage of *Perrine* lemons was studied more in detail on sour orange, rough lemon, *Key* lime, sweet lemon, citrange and *Cuban* shaddock root-stocks in central and south Florida. The difference is approximately 1.3% for the dates when greatest variation was observed. This may possibly be accounted for by variation in rainfall as explained later. (See Plate 1.)

*Percentage of total solids.* Percentage of total solids in general show trends similar to percentages of acids when the root stock and rainfall factors are constant. Within a variety there may be a considerable variation due to root-stock as shown by a much higher percentage of total

solids of fruits grown on sour orange root-stock as contrasted with rough lemon root-stock. Uncongenial graft unions may offer the explanation. There was an average of 9.5% to 10.9% solids for *Perrine* on rough lemon as contrasted with 12.4% for the same variety on sour orange. (See Plate 1.)

*Riciness.* Tests for the past season were made on fresh fruit samples with no attempt at "curing" or holding fruit in storage under controlled conditions. With such fruit samples there was noted a tendency to "riciness" in the *Perrine* lemon, which may explain the lower juice content as compared with other lemon varieties. On future study of this variety, the effect of the curing process on riciness should be considered. Riciness was not encountered in the case of the other lemon varieties included in the experiment.

*Percentage* juice. *Perrine* from various locations and on different stocks had an average extractable juice percentage of 32% to 41%; *Eureka* averaged 40.5%; *Meyer,* 47.8% and *Sperryola* 41.7%. (See Table II.)

*Size. Perrine* from various locations in central and south Florida and on various root-stocks, ranged from 53 to 104 gms. and 1.7 to 2.2 in. in diameter. *Eureka* from south Florida averaged 192 gms. and 2.7 in. in diameter. *Meyer,* 142 to 189 gms. and 2.5 to 2.6 in. in diameter; and *Sperryola,* 66 to 97 gms. and 1.9 to 2.1 in. in diameter. In terms of fruits per pound the average weights for these varieties would give 2.3 *Eureka* lemons; 2.8 *Meyer;* 5.6 *Perrine;* 5.6 *Sperryola* fruits to the pound.

*Percentage of Rind and Rag.* The average percentages of rind and rag for each variety on different stocks are shown in Table II.

*Shape.* As indicated in Table I, *Perrine, Eureka, Meyer* and *Sperryola* are rounded oblong in shape as indicated by the following ratios of length to width—*Perrine* 1.07 to 1.13; *Eureka,* 1.13; *Meyer* 1.12 to 1.15; *Sperryola* 1.01 to 1.12. The presence of a nipple in *Eureka* and both a nipple and persistent pistil in *Perrine* gives an optical illusion of even greater length. *Meyer* without a distinct nipple appears more nearly spherical than is shown by actual measurements.

*Thickness of Rind.* The average thickness of rind for each variety is indicated in Table 1. The differences are chiefly of interest in showing possible stock influences, those grown on the rough lemon and on shaddock stocks having rind thicker than from trees on other stocks.

*Number of seeds.* The number of seeds in *Perrine* lemon is quite variable averaging from 14 to 27 for various series of samples. *Eureka* lemon grown in Dade County has an average of 17 seeds; various series of *Meyer* lemon, 7 to 18 seeds, and *Sperryola* 14 to 20 seeds. (See Table I.)

*Taste qualities. Perrine* and *Eureka* lemons were consistently "very sour," with a pH of 2.06 to 2.8 for the former and 2.35 to 2.38 for the latter. "Bitter" and "immature" taste were present in *Perrine,* and "immature" taste in the early samples of *Eureka. Meyer* lemons were "sour" to "very sour," pH 2.28 to 2.45, and "immature" taste was observed in the early samples. *Sperryola* lemons varied from tart to sour in taste. These relatively low values for "acid" taste in *Sperryola* with a pH range of 2.38 to 2.75 overlapping those of the more acid types is not explained by the data presented. The explanation may be found in percentage of sugars.

*Rainfall and Percentage Acid.* Under irrigated grove culture it would be expected that maturity processes would go on fairly evenly as shown for Texas citrus fruit maturity data (*9, 10*). Under Florida conditions with the onset of the dry season in the late fall, lack of moisture in seasons of drought might affect the results. The past fall and early winter were unusually dry which made it advisable to investigate any possible effect this factor might have on the results. There was found to exist a negative correlation between total rainfall and the amount of acid present—*Perrine* (6 locations in central and south Florida) $r = -0.524 \pm 0.104$; *Meyer* (3 locations in central Florida) $r = -0.418 \pm 0.185$; *Tahiti* (2 locations in central and south Florida) $r = -0.579 \pm 0.129$. This may possibly be explained on the basis that in dry weather the plant tissues lose moisture leading to a more concentrated cell sap with a consequent higher content of acid.

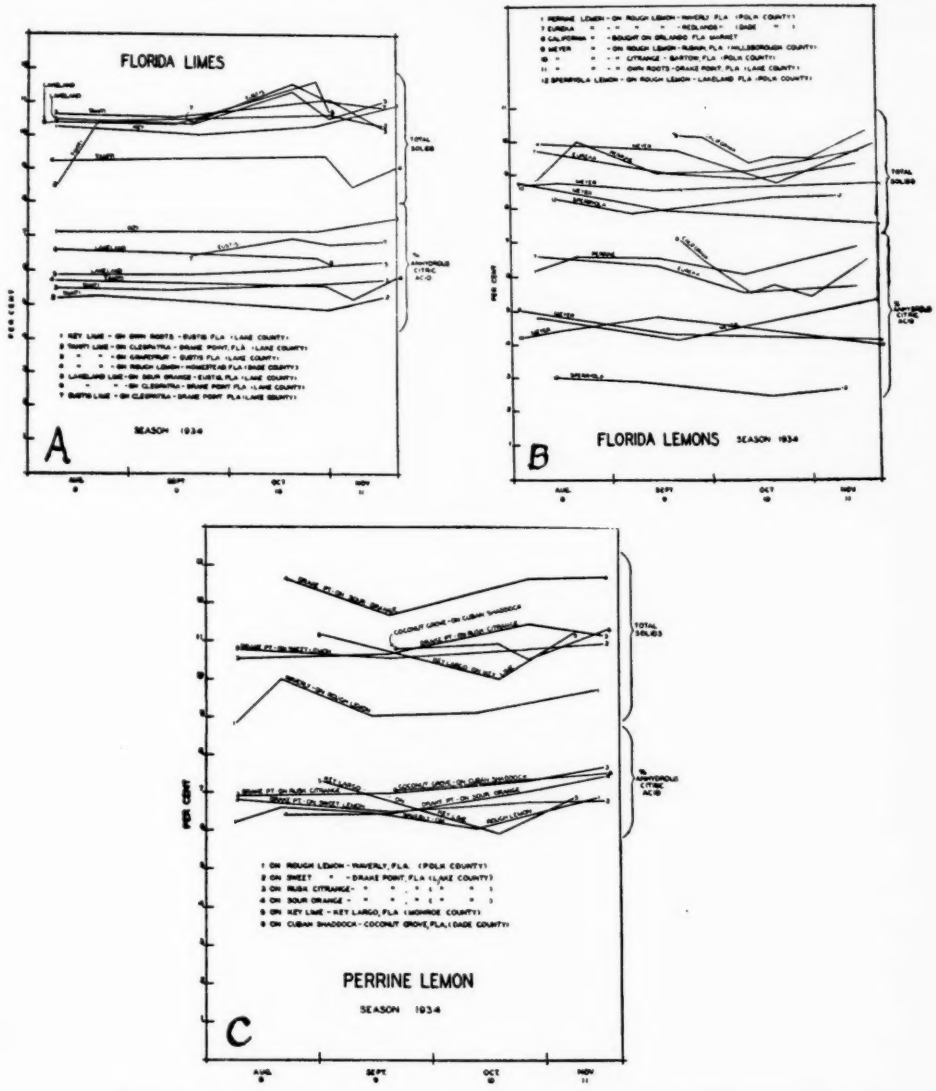


PLATE 1. Florida limes and lemons; variation in percentage of total solids and acids of juice — (A) Florida limes; (B) Florida lemons; (C) Perrine lemon.

TABLE I

ACID CITRUS FRUITS: RIND THICKNESS, SHAPE, NUMBER OF LOCULES AND SEEDS. SEASON 1934

| Variety | Rootstock | Source (County) | Number of locules | | Number of seeds | | Rind thickness mm. | | Length in cm. | | Width in cm. | | Ratio length to width |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | AV. | C.V.* | AV. | C.V.* | AV. | C.V.* | AV. | C.V.* | AV. | C.V.* | |
| **I. LIMES** | | | | | | | | | | | | | |
| Key | Seedling | Lake | 9±.08 | 7 | 8±.52 | 36 | 1.1±.03 | 20 | 4.4±.03 | 7 | 4.3±.03 | 6 | 1.02 |
| Tahiti | Cleopatra | Lake | 10±.07 | 7 | (3 seeds in 50 frt.) | | 2.1±.06 | 32 | 5.9±.03 | 6 | 5.7±.04 | 6 | 1.04 |
| Tahiti | Grapefruit | Lake | 10±.11 | 9 | (3 seeds in 40 frt.) | | 1.6±.06 | 20 | 5.4±.03 | 5 | 5.3±.04 | 7 | 1.03 |
| Tahiti | Trifoliate | Lake | 10±.03 | 3 | (3 seeds in 40 frt.) | | 2.0±.06 | 13 | 5.7±.06 | 10 | 5.5±.04 | 6 | 1.03 |
| Tahiti | Rough lemon | Dade | 9±.13 | 12 | (No. seeds in 40 frt.) | | 2.5±.05 | 19 | 6.0±.05 | 7 | 5.6±.04 | 6 | 1.06 |
| Lakeland | Sour orange | Lake | 6±.01 | 10 | 9±.31 | 34 | 1.0±.02 | 24 | 4.4±.02 | 5 | 4.1±.02 | 6 | 1.07 |
| Lakeland | Grapefruit | Lake | 6±.03 | 4 | 7±.28 | 37 | 0.9±.02 | 25 | 4.4±.03 | 7 | 4.0±.02 | 6 | 1.09 |
| Lakeland | Cleopatra | Lake | 7±.08 | 11 | 9±.40 | 39 | 1.0±.02 | 15 | 4.3±.04 | 8 | 4.2±.04 | 9 | 1.04 |
| Eustis | Cleopatra | Lake | 7±.09 | 11 | 12±.31 | 24 | 1.0±.01 | 12 | 4.3±.02 | 5 | 3.8±.02 | 4 | 1.03 |
| **II. LEMONS** | | | | | | | | | | | | | |
| Perrine | Rough lemon | Polk | 11±.10 | 9 | 20±.83 | 41 | 2.5±.03 | 12 | 6.2±.04 | 6 | 5.6±.06 | 10 | 1.12 |
| Perrine | Sweet lemon | Lake | 11±.15 | 12 | 14±.80 | 48 | 2.2±.10 | 42 | 5.6±.05 | 8 | 5.3±.05 | 8 | 1.07 |
| Perrine | Citrange | Lake | 10±.08 | 7 | 22±.17 | 45 | 2.3±.06 | 24 | 5.7±.05 | 9 | 5.0±.03 | 10 | 1.13 |
| Perrine | Sour orange | Lake | 10±.11 | 10 | 15±.54 | 32 | 1.8±.06 | 31 | 4.5±.05 | 11 | 4.3±.03 | 6 | 1.06 |
| Perrine | Key lime | Monroe | 10±.16 | 12 | 16±.74 | 87 | 2.4±.08 | 26 | 5.6±.02 | 4 | 5.2±.04 | 6 | 1.07 |
| Perrine | Shaddock | Dade | 10±.08 | 6 | 27±.49 | 18 | 3.2±.08 | 24 | 6.1±.04 | 7 | 5.6±.03 | 5 | 1.10 |
| Eureka | Rough lemon | Dade | 9±.13 | 13 | 17±.71 | 17 | 4.2±.09 | 21 | 7.7±.06 | 7 | 6.8±.04 | 6 | 1.13 |
| Eureka | † | (Calif.) | 9±.02 | 3 | 4±.27 | 70 | 2.5±.03 | 15 | 5.3±.08 | 18 | 4.9±.05 | 13 | 1.09 |
| Meyer | Rough lemon | Hillsboro | 10±.47 | 6 | 7±.66 | 54 | 3.1±.06 | 14 | 7.5±.09 | 9 | 6.5±.09 | 11 | 1.15 |
| Meyer | Citrange | Polk | 9±.08 | 8 | 15±.15 | 33 | 2.6±.07 | 24 | 7.0±.06 | 8 | 6.2±.05 | 7 | 1.12 |
| Meyer | Own roots | Lake | 10±.09 | 9 | 18±.57 | 29 | 2.5±.05 | 19 | 7.3±.10 | 12 | 6.6±.10 | 14 | 1.12 |
| Sperryola | Cleopatra | Lake | 10±.13 | 8 | 20±.65 | 26 | 2.0±.05 | 20 | 5.0±.04 | 6 | 4.8±.03 | 5 | 1.05 |
| Sperryola | Rough lemon | Polk | 10±.10 | 10 | 15±.60 | 39 | 2.7±.04 | 16 | 6.1±.05 | 8 | 5.4±.03 | 6 | 1.12 |
| Sperryola | Grapefruit | Lake | 10±.12 | 10 | 14±.68 | 38 | 1.9±.04 | 18 | 5.3±.13 | 20 | 5.3±.04 | 6 | 1.01 |
| Sperryola | Sour orange | Lake | 10±.14 | 11 | 18±.80 | 35 | 2.0±.07 | 28 | 5.2±.06 | 9 | 4.9±.05 | 8 | 1.06 |

*Standard deviation on a percentage basis—coefficient of variability.
†Probably sour orange which is commonly used in California.

TABLE II

ACID CITRUS FRUITS: TOTAL WEIGHT, PERCENTAGE OF RIND, RAG AND JUICE OF WHOLE WEIGHT OF FRESH FRUIT SEASON 1934

| Variety | Rootstock | (County) Source | Total Weight in gms. | | % of rind | | % of rag | | % of juice | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | AV. | CV.* | AV. | C.V.* | AV. | C.V.* | AV. | C.V.* |
| **I. LIMES** | | | | | | | | | | |
| Key | Seedling | Lake | 48± .93 | 18 | 14±.29 | 19 | 30±.60 | 19 | 53.8±.55 | 10 |
| Tahiti | Cleopatra | Lake | 111±1.7 | 16 | 19±.31 | 17 | 32±.33 | 11 | 43.7±.96 | 20 |
| Tahiti | Grapefruit | Lake | 87±1.73 | 17 | 18±.75 | 34 | 32±.70 | 18 | 48.9±.61 | 12 |
| Tahiti | Trifoliate | Lake | 97±2.1 | 20 | 18±.42 | 22 | 29±.62 | 20 | 51.1±.98 | 16 |
| Tahiti | Rough lemon | Dade | 106±1.68 | 15 | 22±.38 | 16 | 33±.60 | 17 | 52.4±.64 | 11 |
| Lakeland | Sour orange | Lake | 44± .68 | 16 | 15±.24 | 17 | 32±.34 | 11 | 50.6±.59 | 12 |
| Lakeland | Grapefruit | Lake | 43± .65 | 14 | 13±.25 | 18 | 32±.43 | 12 | 50.9±.77 | 14 |
| Lakeland | Cleopatra | Lake | 44±1.02 | 22 | 13±.45 | 27 | 30±.40 | 12 | 52.2±.54 | 9 |
| Eustis | Cleopatra | Lake | 37± .41 | 10 | 15±.21 | 13 | 38±.44 | 11 | 41.8±.56 | 12 |
| **II. LEMONS** | | | | | | | | | | |
| Perrine | Rough lemon | Polk | 98±1.19 | 13 | 22±.70 | 33 | 34±.40 | 13 | 32.3±.51 | 14 |
| Perrine | Sweet lemon | Lake | 88±2.12 | 22 | 21±.57 | 24 | 38±.54 | 13 | 33.7±.61 | 19 |
| Perrine | Rusk citrange | Lake | 78±1.68 | 20 | 23±.56 | 23 | 35±.44 | 12 | 37.6±.98 | 21 |
| Perrine | Sour orange | Lake | 53±1.52 | 22 | 24±.51 | 19 | 40±.42 | 10 | 38.2±.86 | 20 |
| Perrine | Key lime | Monroe | 88±1.58 | 15 | 24±.69 | 23 | 36±.62 | 14 | 41.5±.57 | 14 |
| Perrine | Shaddock | Dade | 104±1.41 | 14 | 27±.42 | 16 | 35±.41 | 12 | 33.8±.61 | 19 |
| Eureka | Rough lemon | Dade | 192±3.50 | 17 | 29±.61 | 19 | 28±.36 | 12 | 40.5±.59 | 13 |
| Eureka | † | (Calif.) | 73± .64 | 10 | 25±.26 | 12 | 30±.32 | 13 | 45.1±.48 | 12 |
| Meyer | Rough lemon | Hillsboro | 165±1.36 | 29 | 24±.50 | 15 | 28±.38 | 10 | 47.8±.66 | 13 |
| Meyer | Rusk citrange | Polk | 142±3.33 | 22 | 21±.39 | 18 | 29±.31 | 10 | 48.0±.61 | 9 |
| Meyer | Own roots | Lake | 186±5.46 | 26 | 21±.47 | 21 | 29±.45 | 14 | 49.3±.61 | 11 |
| Sperryola | Cleopatra | Lake | 67±1.19 | 14 | 22±.42 | 16 | 29±.32 | 9 | 41.7±.65 | 12 |
| Sperryola | Rough lemon | Polk | 98±1.40 | 14 | 22±.40 | 19 | 28±.38 | 14 | 46.9±.53 | 11 |
| Sperryola | Grapefruit | Lake | 90±5.17 | 47 | 21±.42 | 16 | 30±.29 | 8 | 42.9±.52 | 29 |
| Sperryola | Sour orange | Lake | 67±1.94 | 23 | 21±.43 | 16 | 27±.42 | 12 | 45.6±.52 | 9 |

*Standard deviation on a percentage basis—coefficient of variability.
†Probably sour orange which is commonly used in California.

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## THE AKEE

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The Akee (*Blighia Sapida*) belongs to family of the Sapindaceae. It was introduced from African Guinea into Jamaica in 1778. Shrublike, handsome, stiff branched tree with beautiful glossy green leaves, it grows within a few years to 20 or 30 feet high. Bears pretty red or orange colored fruits about three inches long in small clusters at the tips of slender branches. Akees require a tropical climate and grow best in rich soil which is not too dry.

The fruit, at first, is pear shaped and forms a soft walled capsule, which splits when ripe into three sections from apex to base, looking like a flower and displaying large round shining black seeds attached to the base by large whitish-yellowish fleshy arils, which is the edible part. When properly cooked, the arils resemble in taste and appearance an omelet; or when gently stewed in butter they taste like sweetbreads with a nutty flavor. The shape of the arils suggests somewhat the fruit of a walnut, or the shape of a brain. The Latin-American name, "seso vegetal" (vegetable brain) is also significant of its shape and taste.

Cases of poisoning in Jamaica have been attributed to eating decayed or unripe Akees, or from drinking the water in which they were boiled. Ripening is indicated when the fruit opens naturally. Decay is shown when the arils show softening. The flesh of the ripe Akee should show some firmness, and no sign of pastiness.

The simplest way to prepare the Akee is to boil it in water to which a little salt has been added. Under this treatment the arils turn a bright yellow and become softer. The water in which the fruit has been boiled should be poured off and rejected.

An excellent way of preparing the Akee into a tasteful dish is light frying in butter. For this purpose use flat frying pan and put enough butter into it to well cover the bottom. Heat gently and then drop the arils into the butter so that they form one single layer which touches the bottom of the pan. Pour a little water in the hot pan so as to thus raise some steam and cover the pan with the lid; now and then taking the lid off long enough to examine progress. The pale color of the arils will promptly change into bright yellow which shows the progress. By shaking the pan gently sideways or by turning the arils over on their other side, the whole will soon acquire a uniform yellow color and the fruit will turn softer. All this takes only a few minutes but requires some watching.

The fruit so prepared is now ready for eating while hot. It may be served as such, or on toast.

Be careful not to heat too violently, so as to prevent charring the food. The latter can be eaten directly or stored away in the ice-box ready for future consumption after re-heating.

The colored people of Jamaica usually eat the Akee together with salted dried or baked fish; sometimes tainted in a hot sultry climate. This circumstance may have been the cause of trouble, together with unripe or decomposed fruit. The

trouble has also been attributed to the few slender pinkish filaments which exist on the intersection of the arils on the glossy black seeds, and which I am told should be removed when the arils are cut off from the seeds before they are boiled or stewed. Others contest this statement.

I have eaten boiled or butter-prepared Akees after they had been kept in the ice-box for several days. After warming them they tasted just as good as when freshly prepared.

I made also some experiments with the raw unprepared fruit.

If the fruit is picked when almost ripe, but has not yet opened, the opening may occur spontaneously after a few days; thus displaying the arills. This opening indicates maturity, and takes place even when the fruit is kept in an old time ice-box. The latter, where the melting ice keeps the air humid, may accomplish this result. On the other hand very dry air, or the modern refrigerators, which are pactically drying devices and extract the moisture from the air or food articles exposed therein, prevent opening as well as ripening. Under such conditions, the fruit instead of opening tightens, shrinks and stiffens to the point of looking like a solid hard nut, totally unfit for eating.

Any fruit that shows signs of moulding or softening should be rejected as suspicious.

Since several years I have shipped by Railroad Express ripe or nearly ripe Akees from my garden in Coconut Grove to my summer residence on the Hudson, during the hot summer months and thence to our camp in the Adirondacks. No special packing was used but newspaper and ordinary fruit crates. Although the fruit was from two to four days in transit and arrived rather warm it was in excellent condition and made a welcome addition to the diet of my family.

Since the last three years, when my trees began to bear, I have repeatedly experimented on myself as to possible ill effects after eating Akee; but never noticed the slightest harmful results. The same observation applies to my family including adults and young children.

However, I should mention that last summer one of our guests at the camp felt indisposed after eating Akee and even suffered vomiting and a strong headache. None of the others, who had eaten from the same dish, felt anything unusual. The guest who showed the above mentioned symptoms arrived after strenuous motor driving on a hot summer day. His indisposition disappeared after forty-eight hours.

I think it highly desirable that some of our biochemists should study the Akee so as to determine scientifically, if, and under what conditions, it may cause the above mentioned disturbances attributed to this fruit. We should know positively whether it contains or produces any special toxic matter. Is it possible that on rotting it develops the same substances which in spoiled fruits or vegetables cause botulism, by the development of the Bacillus Botulinis, often called ptomaine poisoning?

Early in 1928 I planted my first small plants, grown from seeds in pots. Some of these trees are now over thirty feet in height and have spread abundantly their wide side branches with their well shaped glossy green leaves which enhance the contrast of the red color of the fruit. The trunks of these trees have a smooth grayish bark. Some measure now seven inches in diameter. The better trees have fruited regularly since four years. Some of the fruit ripens in midsummer; the next crop occurs towards beginning of spring and is considerably less abundant; due to our very dry winter season and also to colder weather.

This year we had one unusually cold night here when the temperature in my garden dropped to 31° F. Although my bananas and Spathodea campanulata were much affected by the cold, the Akee trees showed no deterioration, and some of the remaining fruit is opening now, beginning April, while new blossom is appearing.

Some of my first plantings were made in very unfavorable soil; namely in spongy coralline lime rock, near sea water, but well above high tide. In this dry soil such trees have not grown so well and have borne scant fruit, as compared to the plants standing in my banana pit of which the soil is rich in humus and keeps its moisture. On this fertile soil the fallen fruit seeded itself and produced many young plants.

Coconut Grove, Florida, April, 1935.

# HISTORY OF MY LICHEE TREE AT MODELLO

**Mrs. Eva E. Collins, Modello**

The lichee tree, as a plant some fifteen or eighteen inches in height, came from Royal Palm Nurseries at Oneco, Florida. It was set out in June, 1919, by my late husband, T. A. Collins.

A hole, three or more feet in diameter, was blasted in the coral rock which forms the bulk of the land in this vicinity, and this hole re-filled with soil gathered from the surrounding area, together with some of the smaller fragments of rock which had been blasted from it. The lichee plant was set in this, and kept shaded and provided with plenty of moisture, until it had attained a good start.

At the time that the tree was planted it was surrounded by small citrus and avocado trees. These trees in the intervening years have grown to large proportions, so that the lichee tree is not only now crowded but gets very little sunshine.

It has received no special attention, and has been entirely dependent for nutriment upon the meagre amount of commercial fertilizer which it has been able to wrest from that applied to the citrus trees surrounding it.

It began to bear in 1926, and in that year put on a heavy crop of nuts. I am informed that in China, the home of the lichee, that the tree does not bear until it is ten years old . Apparently, then, the soil of Florida, or at least that of this vicinity, is more conducive to its development, than that of its homeland.

It was not until 1930 that I became aware of the fact that in this lichee tree I had anything unusual. I was then so informed by Dr. David Fairchild, who has since that time followed with interest the further development of the tree, and has been instrumental in helping me to dispose of to an advantage the crops from the tree.

The nuts, when ripe, are strawberry red in color, corrugated on the outside, and about the size of a walnut. The outside skin peels off easily, disclosing a white jelly-like substance, and inside of this is a black seed.

My tree is, at present about fourteen feet high. It is prolific in foliage, which falling forms a deep mulch, and as this decomposes makes a rich leafy mold, which is now some five or six inches deep around my tree. This possibly accounts for the thriftiness of the tree, in spite of the lack of fertilization and cultivation.

Three of its branches were air-layered in the summer of 1934. These were set in leaf mold from Key Largo. They have put out growth, and are apparently rooting, but have not yet been separated from the parent tree.

It may be of interest to note that while the hurricane of '26 uprooted and blew over some seventy-five per cent. of avocado and citrus trees in this vicinity, it in no way disturbed this lichee tree. It not only held its own against the storm, but bore as usual in the following summer.

Our unusually cold weather this winter had no effect on it, nor has the dry spring prevented it from putting out its usual beautiful feathery bloom. The fruit ripens around the end of June, and now carries with it the promise of a marvellously bountiful crop for '35.

One can truthfully say that it is a wonderful tree, for it fears neither wind, cold nor drought.

## A LICHEE TREE AT GOULDS

**W. O. Talbott, Goulds**

I received a small Lichee tree from the government along about 1915 and the tree has grown to a height of about twenty some feet and has a spread of about twenty feet, making a beautiful tree. I have fertilized this tree with the same fertilizers that I used on my citrus trees.

I think the tree was about fifteen years old before it bore any fruit but after that age it has borne some fruit about every year but not much of a crop until last year when it had, I presume, about three hundred fruit.

The fruit matured very nicely and was of very fine eating quality. The cold weather in December did not seem to hurt the tree at all but it does not seem that it is going to bloom much at present.

The tree makes a beautiful ornamental, but I do not see very great possibility of its fruiting regularly.

Last year I carried a branch with perhaps fifteen or eighteen fruit to Dr. Fairchild at Coconut Grove and he was very much interested in it and he told me he was going to take a picture of it so if the Doctor is present at your meeting he can tell you lots about the Lichee.

## DEVELOPMENTS IN PINEAPPLE PRODUCTION ON THE LOWER EAST COAST OF FLORIDA

**R. A. Carlton, Seaboard Airline Ry., West Palm Beach**

Cold damage to pineapples occurring in the freeze of December, 1934, was largely confined to plantings north of West Palm Beach, both along the coast and the inland sections in Martin and Highlands Counties. The damage was severe enough in these areas to preclude the possibility of a crop for this season, while plantings in Palm Beach and Broward Counties escaped with little damage and a satisfactory crop of fruit is in prospect. Particular reference will be made in this paper to the trend that has developed in the last five years toward the production of pineapples on flatwood soils, and the opportunity offered for the protection of the crop from cold weather by the use of irrigation water when they are grown on this soil type.

The history of the pineapple industry in Florida has been that the Smooth Cayenne and Abbaka varieties were much better adapted to flatwoods soils than the ridge soils, or deep sands, where the Red Spanish variety was generally grown. The productive life of the first mentioned varieties was very short on the ridge soils ,even when grown under shade, and a virtual failure when grown in open. On the other hand, these varieties would remain productive on flatwoods lands, and usually the hardpan phases of these soils, for several years. In the writer's opinion, the moisture supply in the ridge soils fluctuated too much to maintain vigorous growth in these varieties.

The Red Spanish variety developed satisfactory production on these ridge soils, and established unusual records for the number of profitable crops

produced without replanting. The record, so far as I know, is twenty-three consecutive crops, reported by a Ft. Pierce grower. The decline in the production of this variety after the advent of the disease called "Red Wilt" is well known. It may be significant to note that the appearance of Red Wilt and the decline in the production of the Red Spanish variety parallels the creation of drainage districts for the purpose of draining flatwoods lands adjacent to the coast. The outlets for these drainage districts were Indian River, or some other tidewater sound. Consequently, the drainage canals passed through the ridge lands and lowered the water table in the fresh water savannas that were located between the ridge and the flatwoods lands that were to be drained. The lowering of the water supply in the savannas, which had no natural outlets, undoubtedly affected the water table of the ridge soils, which may have been the factor that contributed to the development of the Red Wilt. This idea is a natural supposition on my part after observing the development of plantings of pineapples made on both drained flatwoods and ridge soils in the past five years, the results of which will follow later in the paper.

Until recent years it was a general belief among pineapple growers that the Red Spanish variety would not produce satisfactory crops on flatwoods soils, where the Smooth Cayenne and Abbaka varieties would thrive unusually well. In most instances plantings on this soil type made very poor growth and developed a large per cent. of narrow-leafed plants, or in the parlance of the grower, a condition known as "spike." If any fruit was produced, it was of small size, and probably irregular in shape. The only record of successful plantings of this variety on flatwoods lands were around Stuart where the growers provided small drainage ditches through their fields at regular intervals. The success of these plantings compared favorably with plantings made on the ridge.

After a study of plantings made on flatwoods lands of all varieties, it was determined that most growers attempted to follow the same planting system on this soil type as was followed in plantings on the well drained soils of the ridge. Namely, the plants were set in seven-row beds on the level, and if any additional drainage was provided, it embraced the entire field instead of each individual bed. The result appeared to be improper drainage during rainy weather, and poor aeration with respect to the individual plants. Some growers tried planting on ridges or raised beds, but in every case the type of ridge used was similar to those used for planting citrus on poorly drained lands. As a consequence, the rows of plants on the crown of the beds would grow satisfactorily, while the rows on the slopes of the beds next to the water furrow would develop the same troubles as where they were planted on the level without any drainage channel between the beds.

As a result of these observations, it was recommended to several growers in Palm Beach, Martin and Highlands Counties, who were interested in making plantings of both Abbaka and Red Spanish varieties on flatwoods land, that a system of planting in beds be used in which the length would not exceed 210 feet and the width 18 feet. These beds were to be made up as nearly level as possible with a good deep water furrow between each bed that opened into drainage furrows at the end of the bed. By this system a roadway was left every 210 feet on each side of which was a drainage channel that opened into main drainage outlet for the entire field. In this manner rapid drainage was provided during wet weather, and since the beds were level there was an even distribution of moisture in the beds at all times. Also, in the event it was desired to irrigate during dry weather, an even water table might be maintained, and in the case of using irrigation water as a protection against frost, the beds might be completely surrounded by water, which would insure the maximum temperature benefit. Two general types of planting were followed with this system of beds, viz.: one in which the bed was 14 feet wide and on which six rows were planted 18 by 18 inches. The other on 18 foot bed on which two beds of four rows set 18 x 18 inches were made on each side, leaving a four foot alley in the center to provide for easier cultivation and harvesting. In the case of the 6 row bed, all fertilization, cultivation and har-

vesting was accomplished from the water furrow, while in the 18 foot bed two rows in each bed might be worked from the center alley and the other two rows worked from the water furrow. The latter arrangement avoids the necessity of having to struggle through the plants during the harvesting season.

Plantings under this system were first made in 1932, and each season since that time, of both native Abbaka and Puerto Rican and native Red Spanish slips. Both varieties have given unusually good results in growth and production of fruit. The growth of all plants on this type of bed were vigorous and uniform with little, if any, tendency towards "spike" in any plantings. During the late summer and fall of 1933 unusually heavy rainfall occurred in all localities where these plantings were made, and there were no ill effects to be noted from this condition. The first fruit was harvested from the plantings made in 1932, in the summer of 1934, and in the Abbaka plantings 95 per cent. of the plants fruited, and in the Red Spanish 80 per cent. Incidentally, the Red Spanish plants were set in late September, while the Abbaka plants were set in early August.

A pronounced difference in production was experienced by some growers who planted part of their Red Spanish slips secured from Puerto Rico on the ridge soils in addition to the plantings made on flatwoods lands. Plantings on ridge soils made in 1932 from the same importation of slips as planted in the flatwoods produced only a 35 per cent. crop under the same fertilization and cultivation as the flatwoods plantings that bore an 80 per cent crop. The difference in the moisture supply was the only factor that could be accounted for in making this difference, as both plantings were made on new land, cultivated and fertilized identically.

During the freeze of December, 1934, some growers who had plantings on flatwoods land had available wells they drilled for the purpose of irrigating in the case of cold weather, with the idea that by circling the beds with water considerable temperature benefit might be secured. This idea was proven to be true to an unusual degree in December in that plantings that were irrigated experienced no damage whatever. Apparently, about a nine degree temperature benefit was scured from the presence of irrigation water, as temperature readings made outside the field averaged 25 degrees while the lowest readings inside the area affected by water were 33 and 34 degrees. The temperature of the water as it came from the well was 76 degrees, which gives an idea of how much heat must be liberated before this water would reach the freezing point. An interesting feature to observe was that bearing pineapple plants located on beds are just about the right height to receive the maximum benefit from the heat rising from the water in the water furrow. The fog arising from the water in cold weather appears to drift through the tops and buds of the plants and prevents the formation of frost or quickly thaws any frost that may form in that part of the plant.

The foregoing comments on pineapple production on flatwoods soils are presented as developments that may tend to enlarge the scope of the pineapple industry tremendously, in South Florida in years to come. The fact that pineapples thrive on the hardpan types of flatwoods soils is a special advantage, as this type of land has little agricultural value in the production of other economic crops in its natural state. The high acid content of the soils makes them desirable for pineapple production, whereas the same condition is a detriment to the production of other crops.

I am happy to report that the ineapple industry is making definite progress toward rehabilitation, and I am confident will soon assume its former importance in the Horticulture of South Florida.

## BUSINESS SESSION OF THE KROME MEMORIAL INSTITUTE

Upon motion, which was duly seconded, Mr. Paul Hoenshal of Port Mayaca was elected vice-president of the Krome Memorial Institute for the fiscal year of 1936.

## COMMITTEE APPOINTMENTS FOR 1935

*Nominating Committee:* G. W. Wakelin, Tavares; W. F. Ward, Avon Park; H. J. Edsall, Bradenton.

*Meeting Place Committee:* C. D. Kime, Orlando; A. J. Peacock, Plant City; David Barrows, DeSoto City.

*Auditing Committee:* C. P. Hammerstein, Hollywood; R. O. Compton, Orlando; W. F. Boyd, Eagle Lake.

*Attendance Committee:* J. L. Baskins, Orlando; R. W. Ruprecht, Gainesville; S. F. Poole, Lake Alfred.

*Legislative Committee:* C. I. Brooks, Miami; C. W. Lyons, Tampa; Frank Holland, Winter Haven; R. P. Burton, Leesburg; Clint Bolick, Fort Myers; J. A. Griffin, Tampa; W. J. Ellsworth, Blanton; Forrest D. Banning, Miami; N. A. Reasoner, Oneco; B. D. Barber, Clearwater.

*Semi-Centennial Committee:* F. M. O'Byrne, Lake Wales; Floyd L. Wray, Hollywood; Charles I. Brooks, Miami; A. H. Ahrndt, Palmetto; T. Ralph Robinson, Orlando; H. Harold Hume, Glen St. Mary; P. H. Rolfs, Gainesville; W. T. Garrett, Kissimmee.

*Resolutions Committee:* C. A. Bass, Miami; F. M. O'Byrne, Lake Wales.

## ENTERTAINMENT PROGRAM

*Tuesday, April* 9, 1935

8:00 P. M.—Florida State Horticultural Society Meeting at High School Auditorium. Entertainment numbers by Mr. and Mrs. Wm. Frick.

*Wednesday, April* 10

9:30 A. M.—Florida State Horticultural Society Meeting at Vero Theater. Piano Overture, Miss Wilma Mills, Mrs. C. C. Jewett and Mrs. A. R. Baldwin. Vocal Duet, Mrs. George Loy and Miss Gladys Caesar. Mrs. A. R. Baldwin, Accompanist.

2:00 P. M.—Florida State Horticultural Society Meeting at Vero Theater. Vocal Solo, Mrs. Sarah Halbe, Fort Pierce. Mrs. Wm. Frick, Accompanist. Vocal Duet, Mrs. Sarah Halbe and Mr. Wm. Frick. Mrs. Wm. Frick, Accompanist.

2:00 P. M.—Krome Memorial Institute Meeting at Woman's Club Auditorium. Vocal Solo, David J. Cathcart, Wabasso. Mrs. Cathcart, Accompanist. Flute Solo, David J. Cathcart, Wabasso. Mrs. Cathcart, Accompanist.

2:00 P. M.—Florida Rose Society Meeting at Del Mar Hotel. Vocal Solo, Mrs. Sarah Halbe, Fort Pierce. Mrs. Wm. Frick, Accompanist. Vocal Duet, Mrs. Sarah Halbe and Mr. Wm. Frick. Mrs. Wm. Frick, Accompanist.

3:00 P. M.—Official Opening of Flower Show in Recreation Hall, Pocahontas Park. No charge for admission.

4:00 P. M.—McKee Jungle Gardens open to members without charge.

8:00 P. M.—Florida State Horticultural Society Meeting at High School Auditorium. Vocal Solos by Mr. Sam Roberts, Melbourne. Mrs. Mattie Waters, Accompanist.

*Thursday, April* 11

9:30 A. M.—Florida State Horticultural Society Meeting, Vero Theater. Vocal Duet, Miss Rachel

Brocksmith and Mrs. George Loy. Mrs. Wm. Frick, Accompanist. Whistling Solo, Mr. Kenneth Langbehn. Mrs. Wm. Frick, Accompanist.

9:30 A. M.—Krome Memorial Institute Meeting, Woman's Club Auditorium. Vocal Duet, Miss Rachael Brocksmith and Mrs. George Loy. Mrs. Wm. Frick, Accompanist. Whistling Solo, Mr. Kenneth Langbehn. Mrs. Wm. Frick, Accompanist.

2:00 P. M.—Florida State Horticultural Society Meeting. Novelty Dance, Miss Virginia Forbes. Mrs. Wm. Frick, Accompanist. Vocal Duet, Miss Rachael Brocksmith and Mr. H. C. Stevens. Miss Beulah Stevens, Accompanist.

4:00 P. M.—McKee Jungle Gardens open to members without charge.

4:00 P. M.—Last chance to view Flower Show, Recreation Hall in Pocahontas Park.

8:00 P. M.—Florida State Horticultural Society Meeting at High School Auditorium. Vocal Solo, Miss Elizabeth Sonne. Miss Wilma Mills, Accompanist. Vocal Solo, Mr. Eugene Harbaugh. Miss Wilma Mills, Accompanist.

## NECROLOGY

Your committee regrets to report the passing of some twenty members during the past year or previously. Some of these have been very active, taking part in our programs and discussions, contributing from their personal finances for the benefit of the Society and lending of their influence and giving of their time for movements sponsored by the Society. It is the greatest loss the Society has sustained in recent years. We have enjoyed their associations, and profited by their council. We miss them.

No obituaries are included in this report, but will be included in a special report for the coming year.

COMMITTEE.

## ANNUAL REPORTS

### Report of Secretary
### April 9, 1935

*Balance Sheet*

| | | |
|---|---|---|
| Cash in bank | $ 95.02 | |
| Treasurer | 318.98 | $ 414.00 |
| *Liabilities* | | |
| B. F. Floyd | | $ 414.00 |
| *Statement of Operations* | | |
| Annual memberships 1934 | $204.00 | |
| Sustaining memberships 1934 | 50.00 | |
| Sale of Proceedings | 44.04 | $ 298.04 |
| Expenses—16 items | | $ 322.59 |
| Expenditures in excess of receipts | | $24.55 |

*Cash Receipts*

| | | |
|---|---|---|
| Balance—May 1, 1934 | $119.57 | |
| Receipts | 298.04 | $ 417.61 |
| *Dispursements* | | |
| Expense | | |
| (See operating statement) | $322.59 | |
| Cash in bank, Apr. 9, 1935 | 95.02 | $ 417.61 |

# Deceased Members

M. M. Bass - - - - - - - Avon Park
A. J. Bardin - - - - - - Zolfo Springs
Edwin Binney - - - - - - Fort Pierce
W. E. Bryan - - - - - - - Clearwater
R. H. Bryson - - - Howey-in-the-Hills
Thos. Donnelly - - - - - - - Cocoa
Wm. Edwards - - - - - - - Zellwood
Mrs. E. P. Gribbel - - Philadelphia, Pa.
D. C. Hamilton - - - - - Clearwater
DeWitt House - - - - - - - Malabar
Mrs. Caroline L. Morton - - Titusville
H. Guy Nickerson - - - - - Tampa
Fred A. Rundle - - - - - Lockhart
L. W. Scott - - - - - - Tallahassee
A. C. Terwilliger - - - - Titusville
Dr. J. E. Turlington - - - Gainesville
C. A. Walsh - - - - - - - - Davie
H. J. Wilmshurst - - - - - DeLand
P. K. Yonge - - - - - - Pensacola
O. V. Zangen - - - - - Davenport

## Treasurer's Report
## May 1, 1934, to March 31, 1935

| | | | | | |
|---|---|---|---|---|---|
| Balance on hand May 1, 1934 --- | | $ 682.98 | | | |
| *Receipts* | | | *Disbursements* | | |
| 46 Annual dues 1934 ------- | $ 92.00 | | Painter Printing Co. on '34 Proceedings ---------- | $500.00 | |
| 1 Perennial, 1934 ---------- | 10.00 | | Treasurer's Convention Exp. - | 23.80 | |
| 150 Annual, 1935 ---------- | 300.00 | | Treasurer's Office Exp. ----- | 75.00 | |
| 1 Perennial, 1935 --------- | 10.00 | | Postage ---------- | 42.52 | |
| For previous Proceedings --- | 7.50 | | Printing, Treasurer's Office -- | 5.15 | |
| Overpayments (.30, .15 & .05) | .50 | | Refund Rose Society (33 programs) ---------- | 17.50 | |
| Interest from bonds ($23.43 and $23.32) ------- | 46.75 | | Bank charges ---------- | 2.63 | |
| Advertising 1934 Proceedings | 185.00 | —$ 651.75 | | | |
| TOTAL ---------- | | $1334.73 | TOTAL ---------- | | $ 666.80 |
| | | | BALANCE, March 31, 1935 | | $668.13 |

### STATEMENT OF ENDOWMENT FUNDS
March 31, 1935

| | | | | | |
|---|---|---|---|---|---|
| Balance from 1934 Proceedings | $4499.11 | | First Liberty Conv. 4¼ Bonds | $1100.00 | |
| Less Loan to Society ------- | 1300.00 | | Savings Acct. to Mch. 31, '35 | 2156.85 | |
| Actual Endowment Available | | $3199.11 | TOTAL ---------- | | $3256.85 |
| | | | Plus Loan to Society --- | | 1300.00 |
| | | | TOTAL ENDOWMENT ---------- | | $4556.85 |

## Report of Auditing Committee
## April 11, 1935

We, the members of your auditing committee, beg to report that we have examined the books, vouchers and holdings of the Secretary and Treasurer, and find them to be correct.

(Signed) C. P. HAMMERSTEIN, Hollywood.
RICHARD O. COMPTON, Orlando.
E. M. BOYD, Eagle Lake.

Accepted.

## Report of Executive Committee
## Meeting of March 15, 1935

The regular spring meeting of the Executive Committee was held in the Haven Hotel, Winter Haven, on Friday evening, March 15, 1935. There were present Messrs. Taylor, Floyd and O'Byrne, with Mr. Hume represented by proxy. The visitors included Messrs. Talbot and Horne from Vero Beach, Mr. and Mrs. S. F. Poole.

The details of the programs, meeting places and entertainment were discussed in detail, and the Secretary was instructed to proceed with the completion of the final details for holding the Forty-Eighth Annual Meeting at Vero Beach on April 9th, 10th and 11th. There being no further business, the meeting adjourned, to meet at the call of the Chairman.

Accepted.

## Report of Nominating Committee

Senator John S. Taylor, President,
Florida State Horticultural Society,
Vero Beach, Florida.

Honored Sir:

Your nominating committee begs leave to nominate the following named members for office another year:

President: John S. Taylor.

Vice-Presidents: S. F. Poole, C. W. Lyons, C. I. Brooks.

Secretary: Bayard F. Floyd.

Treasurer: N. A. Reasoner.

Executive Committee: F. M. O'Byrne, Lake Wales; H. Harold Hume, Glen St. Mary; T. Ralph Robinson, Orlando.

Respectfully submitted,

G. M. WAKELIN,
H. J. EDSALL,
W. F. WARD,
*Committee.*

There being no nominations from the floor, a vote was taken and the above officers were unanimously elected for the fiscal year of 1936.

## Report of the Semi-Centennial Committee

Mr. O'Byrne (for the Semi-Centennial Committee): We have no particular report to make except to say that we have held a couple of meetings and plans are under way that are perhaps too ambitious. They may be turned down, but nevertheless, plans are made and will be carried out.

Next came the presentation of the cup offered by the McKee Jungle Gardens for the largest attendance of members from any community outside Indian River County.

## Report of Attendance Committee

Dr. Ruprecht: After carefully checking up the records of membership, we find that the city of DeLand is awarded the attendance cup. I will ask Mr. Sexton to present the cup.

Mr. Sexton: When I decided to give this cup, I did not realize I would have to make the presentation speech and it is rather hard to prepare one while listening to such interesting talkers as Professor Rolfs here and the speaker, Dr. Groff, from China. I feel just about like the man did who was preparing a speech for the presentation of a cup and spent hours and weeks, and the man to receive it spent the same time. When the time came, the first man said, "Here's your cup," and the other fellow said, "O, is that my cup?"

The McKee Jungle Gardens could never have been possible had it not been for the Horticultural Society. It was the men I met in the Horticultural Society who gave me encouragement to go ou. Through them I got plants to put in the Garden and I feel the McKee Jungle Gardens should be identified with the Horticultural Society.

It would be rather hard to carry this cup round over the country, but I believe this presentation will be an incentive for the different communities to come out and attend the meetings of this organization and as a little token of regard this cup will be given each year. I wish to present this cup to DeLand.

Mr. Gilliland, Secretary of the Commercial Club of DeLand, accepted the cup, and said: In behalf of the City of DeLand and DeLand's Commercial Club, we accept this cup with the greatest of pleasure and with the highest appreciation of the honor which prompts it. It is worth while to come to your pretty city and help you celebrate the annual meeting of an organization that has given 48 years of service. I don't see how you have done it. I thank you.

Mr. Sexton: I will say at this time, we appreciate you coming here. For twenty years I have hoped to bring the Horticultural Society to Vero Beach and now you are here you have added a lot of golden hours to our people here and I hope that some time you will come back. Thank you.

# RESOLUTIONS

## Resolution in Reference to Research by Citrus Commission

*Whereas,* there is now before the Legislature of Florida bills creating a citrus commission for the general control including handling and distribution of citrus fruit, and

*Whereas,* such citrus fruits are generally recognized by medical authorities as having especial value from a dietary and medical standpoint, and

*Whereas,* there has never been provided for in this state the proper agency or funds for doing badly needed research work along such lines on Florida citrus fruit, and

*Whereas,* both grapefruit and tangerines are in particular need of the assistance and value of such research work,

*Whereas,* such research work can be of great benefit both to producers and consumers of Florida citrus fruit.

THEREFORE, BE IT RESOLVED that the Florida Citrus Commission be empowered to carry out any research work as they may find necessary and beneficial in the marketing of Florida citrus fruits and

BE IT FURTHER RESOLVED that the Florida Citrus Commission be empowered to finance this work from such funds as may be collected for the advertising of oranges, grapefruit and tangerines.

Passed.

## Resolution in Reference to Creation of Citrus Commission

*Whereas,* there is at the present time in the Legislature in Tallahassee the following prescribed bills relating to the citrus industry of Florida:

Bill entitled to prevent economic waste in the marketing of Florida citrus fruit.

Bills to advertise and promote the sale of oranges, grapefruit and tangerines.

A bill to protect shippers and owners of registered field boxes, crates and other containers used in the production and harvesting of our citrus fruit.

A bill relating to the purchase, handling, sale and accounting of sales of citrus fruit grown in the State of Florida, to prevent fraud and deception therein and to provide for the licensing and bonding of citrus fruit dealers.

A bill to prescribe certain powers and duties of the Commissioner of Agriculture of the State of Florida in the administration and enforcement of this Act and to prescribe penalties for the violation of the provisions of this Act.

A bill to create a Florida State Citrus Commission.

A bill to authorize the Florida Citrus Commission to act and stabilize and protect the citrus industry of the State of Florida.

A bill relating to citrus fruit, prescribing conditions and limitations upon the sale, marketing and processing thereof and the effect of contracts of the sale and marketing and processing agreements.

A bill entitled Citrus Maturity Act, to prohibit the sale or offering for sale, transportation, preparation, receipt, or delivery for transpotation or marketing of any citrus fruit that is immature or otherwise unfit for human consumption, to provide for the enforcement thereof, and to provide penalties for the violation thereof.

*Whereas,* we feel that these bills now before the House are constructive in their nature and will, if passed, have a very beneficial effect upon the citrus industry of Florida.

THEREFORE, BE IT RESOLVED, that the Florida State Horticultural Society now in session at Vero Beach, Florida, endorse the principles as embodied in these bills.

Passed.

## Resolution in Reference to Plant Board Appropriation

*Whereas,* the State Plant Board is charged with the responsibility of protecting the horticultural interests of Florida against introduction of dangerous pests and diseases, and

*Whereas,* the duties of the Plant Board also include eradication and control of such pests and diseases, and

*Whereas,* two serious horticultural fruit pests, namely, the West India Fruit Fly and the Black Fly have been confined successfully up to this time and their spread confined to the Island of Key West, and

*Whereas,* necessary funds are needed for continuance of the control and eradication work in connection with these two pests, and

*Whereas,* the State Budget Commission did not approve the sum of $16,018.00 as requested in the budget of the State Plant Board for this specific work, and

*Whereas,* it is essential that this work be carried on to completion,

Now, Therefore, Be It Resolved, that the State Horticultural Society does request the Legislature of the State of Florida, now in session, to add the sum of $16,018.00 to the annual budget of the State Plant Board.

Passed.

## Resolution in Reference to Lowering of Water Levels

*Whereas,* citrus and other horticultural interests depend greatly upon fresh water bodies within the State, both for soil moisture and protection from cold damage, and

*Whereas,* there has been much unnecessary draining and changing of levels of natural bodies of fresh water within the State, and

*Whereas,* it is felt that the changing of levels of such bodies of water have a direct influence on the well being of horticultural interests in the State,

Therefore, Be It Resolved, that the Governor be respectfully requested to have made an investigation to determine the desirability and practicability of controlling and regulating levels of natural bodies of fresh water within the State of Florida, and

Be It Further Resolved, that the Governor be requested to take the necessary steps to carry into effect the measures required to accomplish the result sought.

Passed.

## Resolution in Reference to Appropriation for Citrus Experiment Station

*Whereas,* the citrus industry of the State of Florida is the most important agricultural or horticultural industry in the State from the standpoints of total investments, annual crop value, payroll value and indirect value to other business and industries, and

*Whereas,* the citrus industry of this State is suffering for lack of knowledge pertaining to fertilizers, soils, production problems, irrigation and frost protection and by-products investigations, and

*Whereas,* the Citrus Experiment Station of the State is our State agency created for securing and developing such information, and

*Whereas,* the Citrus Experiment Station has never been adequately financed for such research work,

Therefore, Be It Resolved, that the Legislature of the State of Florida now in session is hereby requested to add the sum of $35,000.00 per annum to the sum of $11,451.00 as now appears in the report of the State Budget Commission for the Citrus Experiment Station.

Passed.

## Resolution in Reference to Members

RESOLVED, that the members of the Florida State Horticultural Society miss the presence of two of our outstanding members,

W. S. HART, Edgewater,,
L. B. SKINNER, Dunedin,

whose presence is prevented by ill health. The Society extends felicitations and good wishes.

We also note with regret the absence of MRS. HELEN W. CURTIS, who has served as stenographer for so many years. We wish for her a speedy and complete recovery.

Passed.

## REPORT OF MEETING PLACE COMMITTEE

The Meeting Place Committee reported that invitations had been received from several different cities for the 1936 meeting of the Society. These cities were Clearwater, DeLand, Miami, New Smyrna, Sanford, St. Petersburg and Winter Haven. After due consideration, DeLand was selected as the place for the 49th annual meeting of the Society.

## FINAL RESOLUTIONS

*Whereas,* the Forty-eighth Annual Meeting of the Florida State Horticultural Society has been one of great pleasure and profit, and

*Whereas,* its members and officers wish to extend thanks to those who helped to make it an unusually successful meeting, now, therefore,

BE IT RESOLVED, that the thanks of the Society are hereby extended to:

1. THE AMERICAN FRUIT GROWERS, INC., for the orange and grapefruit juice served in the theater lobby.

2. MISSES JEANETTE MICHAEL and DOROTHY KING, who had charge of the registration.

3. MRS. E. G. THRASHER, MRS. G. TOMLINSON and MRS. RACHAEL BROCKSMITH, who very kindly helped in taking down the proceedings of the meetings.

4. MRS. W. H. HUMESTON, and the members of the INDIAN RIVER GARDEN CLUB, for holding their annual Flower Show during the meeting, thus adding greatly to the enjoyment of our stay.

5. The ARTISTS who contributed so liberally of their time and abilities to our entertainment program.

6. To MESSRS. WALDO E. SEXTON and E. G. THATCHER for help in local arrangements and smooth conduct of the meetings.

7. To the management of the McKEE JUNGLE GARDENS, who so graciously permitted our members to visit the Gardens as their guests and who generously contributed the beautiful loving cup as a stimulant to attendance.

8. To the CITIZENS OF VERO BEACH, whose hospitality we have enjoyed immensely during our stay.

9. To the PRESS OF THE STATE, particulary the VERO BEACH PRESS-JOURNAL, for having contributed so liberally of space in their columns for announcing our meetings.

Passed.

MAGNETIC — PERFECTION — EXCELSIOR — MAGNETIC SPRAY

CROWN — MAGNETIC SPRAY — EXCELSIOR — CROWN

EXCELSIOR — MAGNETIC — PERFECTION

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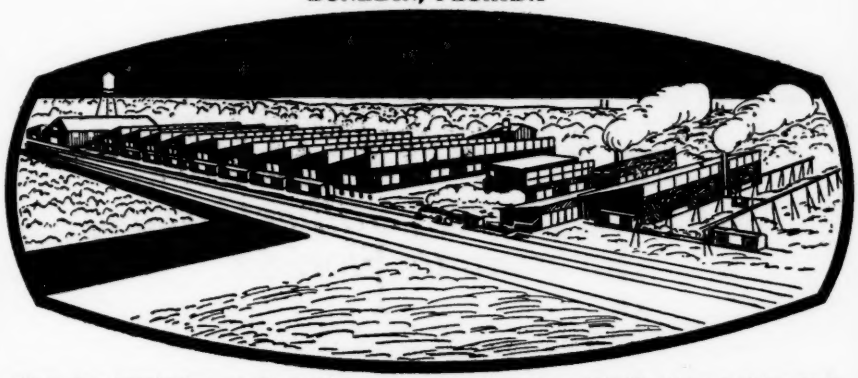

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**"Electric Spray"**—Sulphur, containing 98.5% Refined Sulphur, testing 99% passing a 325 mesh screen. It wets quickly and remains thoroughly mixed during spraying operations. When using a weak lime-sulphur solution during hot weather, build up the sulphur content of your solution with "Electric Spray." It will give your spray the desired fungicidal efficiency and yet cause no foliage injury.

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